pinfa

January 2015 – N° 48

Newsletter for non-halogen fire safety solutions

Innovation

Presafer, pinfa's first member from China

Presafer (Qingyuan City, Guangdong, China) has become pinfa's first Asia-based member company. Presafer is a specialized producer of environmentally friendly, halogen-free flame retardants, based on phosphorus (P) and nitrogen (N). The largest volume product is high-degree polymerised ammonium polyphosphate. The company's main products include Prenipher™, Nitrophor™ and Phoniton™ and combine performance, long-term stability in products and fire safety effectiveness. These products are used in applications including textiles, transport, electronics and construction. The company is ISO 9001 (2008), ISO 14001 (2004) and OHSAS 18001(2007) registered and supplies a worldwide market. Presafer have joined pinfa to contribute to promoting PIN solutions for fire safety, with health and environment profiles preferable to halogenated flame retardants in Europe, America, Asia and Australia, and to collaborate in improving access to information and developments in PIN flame retardants.

Photos: Top: furnace test of cellulose insulation material with Presafer PIN FR. Below: Application of Presafer PIN FR in an electrical socket unit. www.presafer.com

Full-scale furnished room fire tests show limited escape time

For the first time for a decade, new experimental work is published assessing **tenability (how toxic gases and heat prevent escape and kill)** using full-scale furnished rooms. The authors, Guillaume et al., from LNE (French National laboratory for testing and metrology) and LCPP (the Paris Police district Central Laboratory), measured temperature, heat flux, opacity and a range of toxic fire gases in five test fires in a furnished domestic bedroom and adjacent corridor. The room contained a bed (pine), mattress and bedding, furnishing and daily items (wardrobe, desk, table – all wood/fibreboard, rug, clothes, towels, books, CD cases, papers, food packets) and fittings (flooring, electrical ducting). The room was 3m x 3m x 2.5m high, with non -flammable walls and ceiling, and PVC flooring and fittings. Temperatures were measured at heights from 0.8m to ceiling and toxic gases (by FTIR) at height 0.6m to ceiling. The room was fitted with a smoke alarm on the ceiling. In the first three tests, different fire sources were placed on the bedding and the room door remained closed, simulating a fire starting whilst a person is asleep in bed (under ventilated fire). In the last two tests, fires of different sizes were started in waste paper baskets under the desk and the door of the room was opened, simulating a person escaping rapidly.

The paper also summarises previous fire tenability studies carried out on full-scale room set-ups (Grand et al. 1985, South West Research Inst.), Morikawa et al. (1987, 1993), Purser 2000, Gann et al. 2003, single furniture items (Sündstrom 1987) or tenability modelling (Peacock et al. 2004), underlining the **lack of data from full-scale tests relevant to assessing capacity of occupants to escape and risk of toxicity injuries**.

In the first two tests, a smoldering cigarette and a match were placed on the bedding (on the quilt, cotton-polyester fabric, polyester lining). **In both cases, the quilt did not catch fire and did not significantly smolder**. It should be noted that domestic bedding in France is subject to legal fire safety regulations requiring resistance to ignition by a burning cigarette (Décret 2000-164 du 14/2/2000). In the third test (under ventilated, door closed), a small fire (small crib, BS6807 #5, equivalent to a burning ball of paper) is placed on the bedding. No flames are observed for 10 minutes, but **carbon monoxide levels start to rise significantly from 2 minutes**, at which time the smoke alarm activates in the room. The smoke reaches a density such that escape would be compromised for an unknown travel path after c. 3 minutes Concentrations of oxygen fall to levels which would compromise tenability (occupant survival) after c. 4 minutes and carbon monoxide and hydrogen cyanide reach levels which would compromise tenability after c. 6 minutes.

In the last two tests, small fires were lit in waste paper bins under the desk. In one test, the fire was lit in a metal bin containing 500 g of crumpled paper (in this test, the fire burned out in the wastepaper without spreading to the desk). In the second test, the fire was lit in one such bin with a second bin also containing 500g of crumpled paper next to it (the fire spread to the second bin). In this second test the fire alarm activates at 3 minutes 15 seconds, gas toxicity does not reach untenable levels until around 6 minutes and smoke density does not compromise escape (for unknown route) until 5 minutes whereas **temperatures threaten survival from c. 4 minutes.**

The authors conclude that in these full-scale tests smoke alarms in the room where the fire is situated activate in time to make escape possible for a healthy individual. However, **in both cases an individual with inhibited movement (invalid, old or young children) would be at significant risk as there are only 1 – 2 minutes** between smoke alarm activation and both smoke density levels impeding escape and conditions becoming untenable for occupant survival (because of toxic gases in the under ventilated room – door closed, because of temperature in the ventilated room – door open). The authors note that results are highly specific to fire conditions, materials involved in the fire, and risk to occupants are highly dependent on their reaction and mobility in the face of the fire event. In all cases, occupants would be at high risk of death if smoke alarms were not operational or in case of late detection of the fire.

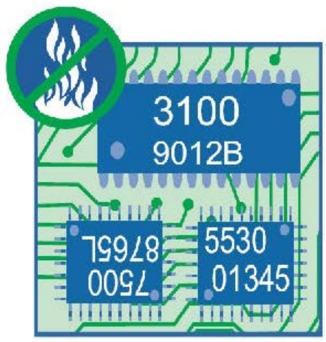
"Real-scale fire tests of one bedroom apartments with regard to tenability assessment", E. Guillaume et al. (Laboratoire National de Métrologie et d'Essais and Laboratoire Central de Préfecture de Police, Paris), Fire Safety Journal 70, pages 81-97, 2004 http://dx.doi.org/10.1016/j.firesaf.2014.08.014

EPA Design for the Environment: alternatives to TBBPA

The US Environmental Protection Agency has published an update of the Printed Circuit Boards Partnership report (DfE: Design for the Environment) on alternatives to the brominated flame retardant TBBPA used in printed circuit boards. **Public comment is open until 15th February 2015**. Most printed circuit boards (PCBs) for consumer electronics are so-called FR-4 boards, which means that they are based on glass-reinforced epoxy laminate sheets and fulfil certain performance requirements including the UL94-V0 fire safety standard. The report, updated from the first publication in 2008, assesses ten flame retardants: TBBPA, 2 reactive and 5 additive PIN FRs and two polymeric FRs (one brominated, one P-based). High persistence is indicated for all flame retardants and is linked to the required chemical stability for their function. Two of the mineral PIN FRs (aluminium and magnesium hydroxide ATH, MDH) achieve “low” or “very low” for all relevant toxicity and environmental end-points (persistence/biodegradability not applicable to inorganics/metals) and two other PIN FRs (dihydro-oxy-phosphaphenanthrene-oxide DOPO and aluminium diethylphosphinate DEPAL / Alpi) show only low to moderate concerns for all other criteria. For some PIN FRs questions regarding long-term health impacts or bioaccumulation suggesting that further optimisation is possible or that data is inadequate.

The updated study looked at smoke and toxicity emissions in different combustion conditions, reflecting both end-of-life incineration and accidental fires. Smoke release was around twice as high for brominated FR boards than for phosphorus FR boards in both combustion scenarios. Emissions of particles were also 25 – 50 higher with brominated FR boards. Brominated FR boards emitted 2-3 times more PAH (poly aromatic carbons) than phosphorus FR boards in both incineration and open fire conditions. Brominated dioxins/furans (PBDD/F) were detected in all scenarios with brominated FR boards.

The report underlines that material performance characteristics are essential for selecting alternative halogen-free flame retardants for circuit boards, including electrical and mechanical parameters, cost and reliability and refers to the iNEMI and HDPUG studies of halogen-free materials, including halogen-free flame retardants. The EPA press release accompanying concludes that “industry trade groups tested alternative non-halogenated flame retardants and found that they function equally as well or better than TBBPA-based circuit boards for certain products”.



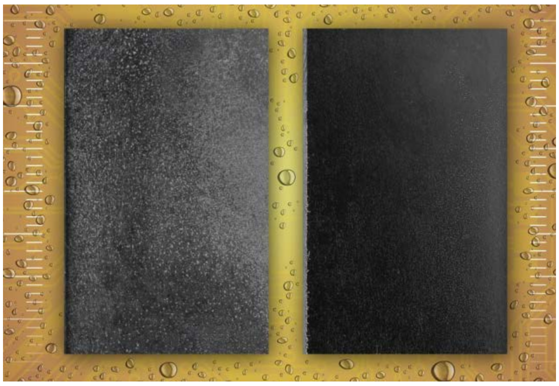
FRs considered in the report: 1 reactive brominated FR (TBBPA); 2 reactive P-based PIN FRs (DOPO, Fyrol PMP); 5 additive PIN FRs (aluminium diethyophospinate, ATH, MDH, melamine polyphosphate, amorphous silicon dioxide); 2 reactive polymeric FRs (DER 500 series - brominated, Dow XZ-92547 - P-based)

“Flame Retardants in Printed Circuit Boards Partnership”, US EPA (Environmental Protection Agency) Design for the Environment (DfE) http://epa.gov/dfe/pubs/projects/pcb/

“Flame Retardants in Printed Circuit Boards – Updated draft report”, December 2014
http://epa.gov/dfe/pubs/projects/pcb/141215_pcb_flame_retardants_report_updated_draft_full_report_and_appendices.pdf

*Public comment on this draft report is **open until 15th February 2015**:*
http://www.epa.gov/dfe/pubs/projects/pcb/index.htm

BASF launches glass fibre reinforced PIN FR polyamide



BASF's new Ultramid® A3U42G6 is a PIN flame retardant, glass fibre reinforced polyamide (PA) offering light colorability and easy processing (low deposits, low corrosivity). The material meets UL 94 requirements for the V-0 flammability class at wall thicknesses as low as 0.4 millimeters. With an RTI for dielectric strength (UL 746B) of 140 °C at a wall thickness of 0.4 millimeters and even 150 °C at thicknesses starting at 0.75 millimeters, the new Ultramid A3U42G6 is especially well suited for use at higher temperatures. The new flame retardant system shows no migration effects and thus ensures component surfaces of higher quality. It also contains no halogen or antimony components. This allows favorable smoke density and toxicity values to be attained. The product is particularly adapted to connectors and for thermally stressed industrial automation parts, such as switches and contactors.

Photo: testing of migration effects: right = Ultramid® A3U42G6

BASF Engineering Plastics:
http://www.plasticsportal.net/wa/plasticsEU~en_GB/portal/show/content/products/engineering_plastics/engineering_plastics

BASF News Release P361, 14th December 2014 "Improved flame retardant grade for E&E applications"
http://www.plasticsportal.net/wa/plasticsEU~en_GB/portal/show/common/plasticsportal_news/2014/14_361

See also pinfa Newsletter n°38 and n°6

pinfa responds to consultation on ammonium salts

pinfa has submitted information to the ECHA (European Chemicals Agency) consultation on the use of ammonium salts to reduce fire risks of cellulose building materials (see pinfa Newsletter n° 46). pinfa emphasises that ammonium salts are recognized to be non-toxic and have been developed as safer alternatives to previously used chemicals. The only risk with their use is a possible release of ammonia gas in conditions of high humidity and temperature, pH. In enclosed spaces, this gas can cause potential irritation to the respiratory tract and eyes but has no long-term or chronic toxic effects. Ammonia salts and ammonia gas are not carcinogenic, mutagenic, teratogenic or impacting on the immune system. Ammonia gas occurs naturally e.g. from animal excretions. pinfa considers that a use restriction should target ONLY situations where a risk of ammonium emissions susceptible to cause irritation may occur, so should be limited to the 3 specific ammonium salts proposed by France*, and should not apply to forms of ammonium salts which are processed or applied such that gas emissions cannot occur (stability or encapsulation systems, polymer forms), in order to enable continuing use of ammonium salts (a recognized, non-toxic, effective fire safety solution) and to not prevent positive innovation.

** ammonium sulphate, ammonium dihydrogenorthophosphate, diammonium hydrogenorthophosphate*

ECHA public consultation on "Ammonium salts in cellulose insulation materials used in buildings" (closed 18/12/2014)
http://echa.europa.eu/restrictions-under-consideration/-/substance/6315/search/+/term

pinfa position: http://www.pinfa.eu/media/news/230-pinfa-position-on-ammonium-salts-in-cellulosic-insulation-materials.html

“Europe is Playing with Fire”

80 Members of the European Parliament (MEPs) and candidate MEPs have signed a pledge to work for a fire safe Europe, as proposed by the European Fire Fighters Unions Alliance (EFFUA). The fire fighters write that more than 4 000 people die annually in fires in Europe and that fires are becoming “*bigger and more dangerous*”. Today a “small fire can become a blazing inferno in less than 3 minutes - injuring and killing the building occupants before the emergency services can arrive on the scene”, whereas 40 years ago it would typically take 25 minutes for a fire to become out of control. The fire fighters’ campaign emphasises that fire safety test methods need updating, in particular to better take into account smoke toxicity, which is responsible for more than half of fire deaths.

IFP Magazine E-Newswire, December 2014 http://ifpmag.mdmpublishing.com/europe-must-tackle-fire-safety-flaws-says-new-white-paper/

Fire Safe Europe / Fire Safety First www.firesafeeurope.eu

Fire Safe Europe white paper “Europe is playing with fire: a call to action on fire safety in buildings”,2nd December 2014 http://www.firesafeeurope.eu/uploads/Modules/Publications/europe-is-playing-with-fire-_-white-paper_fseu_03_12_2014.pdf

Afumex LSX cables chosen for care village

Prysmian’s Afumex LSX LS0H (Low Smoke Zero Halogen) cables a have been selected for the UK£ 1 million electrical installation at the new Edenholme Care Village, Scotland. The cables will provide small power and lighting circuits throughout the new development, designed to provide 21st century care to older people. Aberdeenshire Council underlined that the cables respect standards specifications. The services contractor Richard Irvin underlined the puncture protection offered by the cables. Afumex LSX low smoke zero-halogen cables are flame retardant to improve fire safety and to continue to provide power and control in case of fire. They emit low levels of smoke and of toxic fumes in case of fire and are particularly recommended for highly populated, enclosed public areas. They are designed to ensure compact installation, minimising space loss and maximising useful space in buildings.

http://www.afumexcables.co.uk/ *See also pinfa Newsletter n° 26.*

Biosourced PIN flame retardants

Research shows that two renewable PIN flame retardants can be combined: Phosphorus based phytic acid (widely present in plant seeds) and Nitrogen containing chitosan (derived from natural chitin, present in the structures of fungi, crustaceans …). The two renewable compounds were combined to produce a polyelectrolyte complex (PEC), which was then reacted onto EVA (ethylene-vinyl acetate) fibres. EVA is widely used in many applications, including wires and cables where fire safety and low smoke are required. A reduced peak heat release and total heat release were achieved, with a full and compact char layer, without deterioration of the fibres properties (ductility, tensile strength, viscoelacticity).

"Chitosan/Phytic Acid Polyelectrolyte Complex: A Green and Renewable Intumescent Flame Retardant System for Ethylene-Vinyl Acetate Copolymer", T. Zhang et al., Ind. Eng. Chem. Res. 2014
http://pubs.acs.org/doi/abs/10.1021/ie503421f

PolyFlame: Full scale fire gas tests of PIN FR cables

'PolyFlame', the newsletter of the French Chemical Society (SCF), has published results of full-scale fire gas emission tests on cables carried out as part of the OCDE Prism2 programme, with an objective of assessing cable safety in nuclear installations. The tests used one halogen-free FR cable (mineral PIN flame retardant ATH aluminium tri hydroxide) and two chlore-containing PVC cables. Several hundred metres of electrical cables were laid out horizontally on vertically-stacked racks, then subjected to fire in well-ventilated conditions. The PIN FR showed a significantly delayed CO_2 emissions peak, suggesting a longer delay before full development of fire (c 25 minutes compared to c. 5 minutes)The PIN FR also resulted in lower smoke toxicity with no detectable emissions of hydrochloric acid (HCl, which was emitted by the PVC cables, and considered by the authors to represent corrosivity), 10 – 15 times lower emissions of carbon monoxide (CO, often the most lethal fire gas) and significantly lower emissions of methane, ethylene, acetylene and benzene.

P. Zavaleta & L. Audouin, IRSN (Institute for Radioprotection and Nuclear Safety), Saint Paul lez Durance, France, in PolyFlame Newsletter n°6, October 2014 (in French), Société Chimique de France www.polymer-fire.com

Phytate: from agriculture's problem to bio-sourced PIN FR

Much of the phosphorus present in crops (cereals in particular) is present as "phytate" ($C_6H_{18}O_{24}P_6$ see below). This form of phosphorus poses issues in agriculture and food, because it cannot be digested by mono-gastric animals (such as pigs, chickens, humans). Thus, the phosphorus content is not available, so in pig feed for example it is effectively lost to manure. Also, phytate bonds to metal ions (complexes), thus rendering important minerals such as calcium or iron non-available in animal or human foods. Scientists in Belgium, working on BioRefineries (making valuable products from agricultural wastes and non-food by-products) are looking at turning the phytate problem into a valuable, bio-sourced PIN flame retardant. Phytate has two properties which make it potentially interesting as a PIN flame retardant: its phosphorus content and its capacity for complexing with metals (to produce phosphorus-inorganic FRs). Different phytate – metal complexes have been tested as PIN flame retardants in the bio-sourced polymer poly lactic acid (PLA), with aluminium phytate salts showing the best fire performance (up to 40% reduction in peak heat release). The authors are also testing other bio-sourced PIN flame retardants, in particular microfibers of cellulose (CNC cellulose nano crystals) treated with urea and phosphoric acid (CNC-P), and synergies of these products with the phytate salts presented above.

F. Laoutid & P. Dubois, Service des Matériaux Polymères et Composites (SMPC), Université de Mons - Materia Nova, Mons, Belgique, in PolyFlame Newsletter n°6, Oct. 2014 (in French), Société Chimique de France www.polymer-fire.com

Proposed End-of-Waste criteria outline for plastics

The European Commission has published a report outlining proposed End-of-Waste criteria for waste plastics intended for conversion into recycled plastics products. The report indicates that "*Most additives in use [in plastics] are not known to have environmental or health risks*" but cites as identified as having environment/health risks "*a few problem substances*" including some halogenated flame retardants. The report notes that measures are already in place to identify and separate plastics containing halogenated FRs: these measures include the obligation to remove plastics containing brominated FRs from any separately collected electrical / electronics waste (EU WEEE Directive), non-mixing of such plastics (EU End of Life Vehicle Directive), classification in "Category C" of plastic waste containing halogenated FRs (in the UK). The report suggests that this separation is adequate to ensure safety of recycling of plastics containing flame retardants, subject to respecting legislation on hazardous materials, substances of very high concern and POP's.

European Commission Joint Research Centre "Technical proposals, End-of-waste criteria for waste plastic for conversion", October 2014, ISBN 978-92-79-40944-8
http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/33010/1/2014-jrc91637%20.pdf

Other News

Organophosphorus (OP) flame retardants: a review of environmental studies on OP substances used as plasticisers or FRs looks at human exposure to 3 halogenated OPFRs, 6 OP plasticisers and 3 non-halogen OPFRs. The non-halogen OPFRs were not bioaccumulative and human exposure through food or breast milk feeding was negligible. Exposure to additive OPFRs through inhalation of indoor air or through dust was considered to be of possible concern and further research on long-term health effects of low-level exposure is called for. Further development of "reactive" phosphorus FRs, which react into polymers and which do not risk emissions from products, would avoid these exposure questions.

FRs in a food web: in a study of FRs in an estuary food web in the Netherlands, OPFRs did not tend to accumulate in lipids in organisms, indicating that they do not bioaccumulate. Three of the OPFRs showed some trophic magnification (higher levels in higher organisms) in benthic (bottom dwelling) organisms, probably due to uptake from sediments.

PFR breakdown and excretion: a study of around 50 mothers and their children in Norway shows concentrations of di-aryl phosphorus esters (DAPs) in urine proportional to levels of tri aryl phosphorus PFRs (TAPs) in household dust and to time spent indoors. This confirms that these PFRs are broken down and their metabolites eliminated in urine.

"Review. Organophosphorus flame retardants and plasticizers: Sources, occurrence, toxicity and human exposure", G-L. Wei et al., Environmental Pollution 196 (2015) 29e46
http://www.sciencedirect.com/science/article/pii/S0269749114003923

"Tracing organophosphorus and brominated flame retardants and plasticizers in an estuarine food web", S. Brandsma et al., Science of the Total Environment 505 (2015) 22–31
http://www.sciencedirect.com/science/article/pii/S0048969714012510

"Human exposure pathways to organophosphate triesters — A biomonitoring study of mother–child pairs", E. Cequier et al., Environment International 75 (2015) 159–165 http://dx.doi.org/10.1016/j.envint.2014.11.009

Agenda

Events with active pinfa - pinfa-na participation are marked: ►

2-4 Feb 2015	San Francisco, USA	Fire and Materials 2015 http://www.intersciencecomms.co.uk/html/conferences/fm/fm15/fm15cfp.htm
4-6 Feb 2015	Madrid	COST MP1105 Workshop on “Advances in Flame Retardancy of Polymeric Materials” and 7th Asia-Europe Symposium on Processing and Properties of Reinforced Polymers (AESP7) https://aesp7.org/fire-retardant-workshop/
18-19 March	Cologne, Germany	Green Polymer Chemistry 2015 www.amiplastics.com/events/event?Code=C637
26-27 March	Bucharest, Romania	COST MP1105 workshop “Advances in the synthesis and characterization of nanomaterials for flame retardant applications” COST.MP1105@UGent.be
26-27 March	Vienna, Austria	7th International Symposium on Fire Safety in Railway Systems http://www.railway-network.eu/english/fire-safety-2015.html
30 March – 2 April	Budapest, Hungary	7th European Combustion Meeting http://www.ecm2015.hu
14 April	Safety Harbor, Tampa, Florida	Fire Testing for Codes & Regulations, Marcelo Hirschler (GBH International) mhirschler@gbhinternational.com
15-16 April	Safety Harbor, Tampa, Florida	► Meeting Flammability Requirements for Commercial Buildings & Construction (**pinfa-na** and **The National Pollution Prevention Roundtable**) http://www.pinfa-na.org ***Preliminary speakers list now online***
12-13 May	Denver, Colorado	Fire Retardants in Plastics (AMI) http://www.amiplastics.com/events/event?Code=C648
17-20 May	Stamford, Connecticut	BCC Flame Retardancy Conference (18-20 May) and (17 May) industry seminar http://www.bccresearch.com/conference/flame
16-18 June	Nicosia, Cyprus	2nd European Symposium of Fire Safety Science http://www.iafss.org/2nd-european-symposium-of-fire-safety-science/
22-25 June	Berlin, Germany	►FRPM 15th European Meeting on Fire Retardancy and Protection of Materials http://www.frpm2015.bam.de/en/home/index.htm
28-30 Sept	Cambridge, UK	6th International Symposium Human Behaviour in Fire http://www.intersciencecomms.co.uk/html/conferences/hb/hb15/hb15.htm
5-7 Oct 2015	New Delhi	Fire India http://www.fire-india.com/
5-7 Oct 2015	Tsukuba, Japan	10th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) http://www.iafss.org/10th-aosfst/

Calls for papers

Deadline:	15 Jan 2015	Fire Retardancy and Protection of Materials, FRPM, 22-25 June 2015, Berlin http://www.frpm2015.bam.de/en/home/index.htm

Publisher information:

This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies. ***Abbreviations****: See pinfa website: http://www.pinfa.eu/library/glossary-of-abbreviations.html*

pinfa

Newsletter for non-halogen fire safety solutions

February 2015 – N° 49

Flammability requirements for commercial buildings

15-16 April – Tampa – Florida


Meeting Flammability Requirements for Commercial Buildings & Construction April 15-16, 2015

CONFERENCE DATES:

April 15 — 16, 2015

Add to Calendar

CONFERENCE LOCATION:

Safety Harbor Resort and Spa
105 N Bayshore Drive
Safety Harbor, FL 34695

Driving Directions

To receive the discounted room rate ($139) for Flammability Requirement / Pinfa Workshop, please call 1-888-BEST-SPA (237-8772) / 727-726-1161 (on-line reservations not available). Space limited, book now.

ABOUT THE WORKSHOP:

Pinfa NA and The National Pollution Prevention Roundtable are sponsoring this event to present trends in the building and construction industry that will affect the choice of flame retardants & building material solutions. Attendees will hear from building materials OEMs, architects, regulatory experts & solutions providers regarding needs in the changing commercial building & construction industry.

An introduction to the latest developments in flame retardant technologies will be presented on the opening afternoon. A primer course on fire retardants, flame retardant materials & the most important industry fire test methods will also be presented. The conference will continue with presentations from experts in the construction field regarding environmental, regulatory & testing requirements as well as advanced manufacturing & materials technologies.

WHO SHOULD ATTEND:

OEMs; Designers; Manufacturing; Market Development; Supply Chain; Regulatory, Green Chemistry & Building Organizations

Register Now!

Click below for more information

pinfa North America (pinfa-na) and the National Pollution Prevention Roundtable are organising a workshop on "Meeting Flammability Requirements for Commercial Buildings and Construction" (15-16 April). It will be preceded by a one-day course "Fire Testing for Codes & Regulations" (April 14) by Marcelo Hirschler, GBH International. The conference will bring together plastic formulators, polymer producers, flame retardant manufacturers, construction material OEMs, component manufacturers, as well as government and non-governmental organizations to discuss fire safety and environmental topics critical to the commercial building and construction industries. Speakers will include Clean Production Action, Underwriters Laboratory, General Cable Company, US Green Building Council, US EPA, PolyOne Corporation, Communications Cable & Connectivity Association, Eastman Chemical Co., Keller Products Inc., Firestone Building Products, as well as R&D experts and flame retardant industry leaders.

"Meeting Flammability Requirements for Commercial Buildings & Construction", 15-16 April 2015,
"Fire Testing for Codes & Regulations", one day cours, 14 April, Safety Harbor, Tampa Bay, Florida.
Programme: http://www.pinfa-na.org
Registration: http://events.r20.constantcontact.com/register/event?llr=ccdjsljab&oeidk=a07ea1o6uwwcfcd8bf5&oseq

High performance material for lithium ion battery casings

Bayer has launched Bayblend® FR4000, an innovative "environmentally friendly" PIN flame retardant polymer blend designed for demanding automobile and electronics applications and other high performance requirements. Thermal stability, weathering durability, chemical resistance, UV stability and low-temperature impact strength enable application in vehicle lithium-ion batteries, where flame retardancy is essential. A mineral-filled blend is adapted for large structural components with thin wall thickness. Fire performance of UL94 V-0 (1.5 mm thickness) and IEC 60695-2-12 (glow wire flammability, 960°C) are achieved. Bayer's Bayblend® thermoplastics are based on combinations of polycarbonate and ABS (acrylonitrile butadiene styrene).

Bayer Bayblends®:
http://www.plastics.bayer.com/en/Products/Bayblend.aspx

"Bayblend® FR4000 series – a new generation of flame-retardant polycarbonate blends. High thermal stability and resistance to weathering"
http://www.press.bayer.com/baynews/baynews.nsf/id/High-thermal-stability-and-resistance-to-weathering

Washington metro smoke death

One person died and over 80 were hospitalised when a Washington Metro train stopped and filled with smoke on 11th January. Authorities indicate that the smoke was caused by electrical arcing from the third rail (which supplies high-voltage power to the trains) around 300m ahead of the train. The train was unable to return to the nearest station and away from the smoke, possibly because of the power failure. No fire started, and the death and injuries were all caused by the dense, black smoke. The Washington Metrorail system, which dates from the 1970s and still uses some original rolling stock, had over 80 cases of smoke and fire per year in 2013 and 2014. In most cases the fires and smoke release were contained, which shows the effectiveness of fire safety treatment of materials. However, this tragic incident indicates the need to further reduce smoke generation and its dangers.

http://abcnews.go.com/US/print?id=28186555

"The world can really benefit from flame retardant wood"

High school students and a polymer research centre have teamed up to develop "a sustainable method to make wood used in construction flame retardant". Funded by the Garcia Research Scholar Program, in cooperation with Stony Brook University, the project looked at combining the PIN flame phosphorus RDP into a compound (patent pending) to impregnate wood's natural structure, resulting in a wood-plastic composite with UL94 V0 fire performance, which is more effective than current commercially available solutions. RDP has been identified by the US Environment Protection Agency as a preferred substitute for halogenated flame retardants. The pure product can have toxicity issues, but it is safe once incorporated into materials such as clays or cellulose and can ensure fire protection without decomposing into potentially toxic by-products in case of fire. One of the student team explained: ""*What interested me the most was that it could be used to safeguard homes and buildings. The idea that the world can really benefit from flame retardant wood was my greatest motivation for this project*".

http://www.redorbit.com/news/science/1113310512/students-develop-eco-friendly-flame-retardant-010815/

Orbis PIN FR pallets get approval

Orbis Corp. reusable packing specialists have obtained Factory Mutual Insurance (FM) approval for non-halogen fire-retardant reusable pallets, an industry first, with a line of 18 different pallets, including HF RackoCell® able to edge-rack up to 2,200lbs (c. 1 metric ton).

Orbis states that the new PIN FR pallets enhance safety, health and environmental impact of supply chains, whilst ensuring material performance for customers. Orbis is part of Menasha Corp., one of the USA's oldest family-owned manufacturing companies and has a strong sustainability stewardship policy, including both life cycle assessment to compare reusable packaging with one-use, and monitoring of company resource consumption and waste production.

Source http://reusables.org/3896/general/orbis-corporation-receives-factory-mutual-approval-on-new-fire-retardant-material-free-of-halogen and www.orbiscorporation.com

Insulation fire safety standards are effective

Fire safety expert, Marcelo Hirschler, writing in Fire Safety & Technology Bulletin (10/2014) presents the success of US building code obligations for fire safety standards for insulation materials. Several major fires involving non-residential buildings, in which materials not compliant to US standards were used (either illegally in the US, e.g. foams purportedly used as decoration, or outside the US), have shown the dangers of non flame retardant foams. Under US codes, foam insulation materials can only be used in construction of homes and other buildings if a fire test related to the end-use configuration has been carried out on the complete manufactured assembly. Insulation within structural areas is identified as the first ignited item in only 2% of home fires (Ahren, NFPA, 2013). US codes also require testing of the plastic foam on its own (based on ASTM E84). Mr. Hirschler underlines that this additional testing of the foam itself almost certainly improves the level of fire safety for home and building occupants.

M. Ahrens, NFPA "Home structure fires", April 2013 http://www.nfpa.org/research/reports-and-statistics/fires-by-property-type/residential/home-structure-fires

FSTB Fire Safety & Technology Bulletin, GBH International http://www.gbhinternational.com/images/bulletin.pdf

PIN flame retardant polymers for moulding and extrusion

Lubrizol Engineered Polymers has launched a new non-halogen flame retardant polyurethane, under its Estane® TPU product line, for applications such as processing parts, electronics components and packaging, and industrial applications. The thermoplastic polyurethanes (TPUs) Estane® ZHF85AB3 and ZHF90AB3 are polyester based and offer high mechanical strength and hardness (85A, 90A). Estane® ZHF85AT8 is polyether based with a hardness of 85A. All three products offer excellent extrusion performance, silky matt finish and high fire resistance (UL94 V0 and UL 1581 VW-1). The Lubrizol Corporation is a Berkshire Hathaway company, based in Ohio, USA.

"Lubrizol launches new non-halogen Flame Retardant TPU products", 8th December 2014 http://newscenter.lubrizol.com/phoenix.zhtml?c=250972&p=irol-newsArticle_print&ID=1995918 and www.lubrizol.com

"Fire Fighter Inside"

Melos, specialist compounder founded in 1930, presents the 3D-animation clip "FM Firefighter in Action", showing a fireman appearing from the inside of a cable, representing the protective function of halogen-free, low smoke and highly flame retardant cable bedding compounds. Bedding compounds with very high fire performance (Loss of Oxygen Index LOI up to 80%), through PIN flame retardants, can be a cost effective and innovative solution for achieving fire safety standards in cables for electrical power transmission, instrumentation, telecommunications and data. Melos' and Inhol's FR Bedding, in combination with halogen free flame retardant (HFFR) cable sheathing and insulation, enable high levels of fire safety to be combined with low smoke toxicity. The video clip presents the PIN flame retardant function as positive and essential for safety.

1 minute video clip: https://www.melos-gmbh.com/en/videos/firefighter/

DuPont: halogen-free dominates for E&E applications

DuPont Performance Polymers has launched two new grades of advanced materials, with performance and sustainability objectives: DuPont™ Rynite® PET, FR533NH, and DuPont™ Zytel® FR95G25V0NH PA. Both are halogen-free (no halogen added as an intended ingredient) flame-retardant polymers to replace thermosets for housings, sockets and switches in electrical and electronics applications (E&E). Both materials offer exceptional long-term heat ageing performance (RTI) and outstanding flammability ratings (e.g. UL94 V0 down to 0.4mm), combined with electrical and processing performance. DuPont underlines that the PIN flame retardant materials are designed to match customers' needs for sustainable solutions ensuring economy and performance in meeting critical challenges in E&E applications such as branching & control, switches and relays, communications and power generation systems.

DuPont http://www.dupont.com/industries/plastics/press-releases/solutions-for-electric-food-optical-fibers.html

New elastomers meet railway fire-safety standards

BORFLEX® Cafac-Bajolet, France, has introduced three halogen-free flame retardant (HFFR) elastomers achieving the new European railway fire-safety standard EN45545. Flametsop® 701, 702 and 703 offer HL1, 2 or 3 respectively for R23 and R24 and T01, T10.03 and T12. Flamestop® 701 and 702 also pass ASTM E662, ASTM C1166 and SMP 800-C. The elastomers are easily extrudable and moldable and are adapted to applications requiring high levels of safety and functionality, such as door or window seals, gaskets and sensitive edges.

Source www.borflex.fr

Flame retardant market reports

2014 Market Research Report on **Global Flame Retardant Industry** (9Dimen Research, 7/2014), covers North America, Europe and Asia, including information on prices, capacity, supply and demand, industry growth rate, assessing market entry and investment feasibility

http://www.radiantinsights.com/research/2014-market-research-report-on-global-flame-retardant-industry

Global and China Flame Retardant Fabric Industry 2014 Market Research Report (QYResearch, 11/2014), covering China and global, looking at fabric flame retardant industry chain including equipment suppliers and downstream users, covering markets, production and investment return analysis.

http://www.radiantinsights.com/research/global-and-china-flame-retardant-fabric-industry

Global and China Flame Retardant Industry Report, 2014-2016 (ResearchInChina, July 214), underlines the growth of the flame retardant market in Asia (now over 31% of world market), and the growth of PIN flame retardants (organophosphorus FRs nearly 10% growth 2010-2013): "in view of the factors such as environmental policies and market demand, a growing number of Chinese manufacturers have begun to turn to non-halogen flame retardants".

http://marketpublishers.com/report/industry/other_industries/global-n-china-flame-retardant-industry-report-2014-2016.html

Other news

TCSA watch list: The US Environment Protection Agency (EPA) has added 23 chemicals to its TCSA Work Plan for Chemical Assessments in the Plan's first update. These include the brominated FRs DecaBDE and HBCD are identified as high ranking for potential hazard, exposure, persistence and bioaccumulation (both already EPA Action Plan chemicals) and two phosphorus ester FRs (triphenyl phosphate TPP and isopropylated phenol phosphate iPTPP) because they are being produced, imported or used in greater quantities and an increasing range of consumer products.

US EPA TCSA Work Plan update http://blog.verdantlaw.com/2014/10/23/epa-updates-tsca-work-plan-23-chemicals-added-to-list-for-further-review/ and http://www.epa.gov/oppt/existingchemicals/pubs/TSCA_Work_Plan_Chemicals_2014_Update-final.pdf

California requires FR labelling: California Bill (SB)1019, signed into law in September 2014, requires upholstered furniture (which has to meet California TB117-2013 fire safety standards = smoldering cigarette resistance) to include a label stating that it meets the fire safety standards and indicating whether or not it contains "flame retardant chemicals". The Californian authorities still need to define the analytical test procedure which is used for checking for the presence of FRs. Therefore, FRs that react into the polymeric matrix may be exempt.

California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation (BEARHFTI), see under "Bill 1019" http://www.bearhfti.ca.gov/

US NFPA launches furniture flame test development: the US National Fire Protection Association has initiated development work to define a new open flame test for upholstered furniture fire safety assessment (NFPA 277). This follows decision by the NFPA Standards Council. The development will be taken forward by a technical committee, assisted by a task group involving interested parties.

Video 2 mins, NFPA Open Flame Testing For Upholstered Furniture https://www.youtube.com/watch?v=gm3nchG9Y2c

NFPA 277 project: "Standard methods of tests for evaluating fire and ignition resistance of upholstered furniture using a flaming ignition source" http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=277

Agenda

Events with active pinfa - pinfa-na participation are marked: ►

2-4 February	San Francisco, USA	Fire and Materials 2015 http://www.intersciencecomms.co.uk/html/conferences/fm/fm15/fm15cfp.htm
4-6 February	Madrid	COST MP1105 Workshop on "Advances in Flame Retardancy of Polymeric Materials" and 7th Asia-Europe Symposium on Processing and Properties of Reinforced Polymers (AESP7) https://aesp7.org/fire-retardant-workshop/
11-12 March	St. Avold, Moselle, France	Matching fire retardant solutions to industrial constraints, French Chemicals Association (SCF) http://plastinnov.blogspot.fr/2014/12/adequation-entre-solutions-retard-au.html
18-19 March	Würzburg, Germany	Trends in Fire Safety and Innovative Flame Retardants for Plastics http://www.skz.de/de/weiterbildung/fachtagungen/lehr_/Trends_in_Fire_Safety_and_Innovative/108..html?detID=7431
18-19 March	Cologne, Germany	Green Polymer Chemistry 2015 www.amiplastics.com/events/event?Code=C637
26-27 March	Bucharest, Romania	COST MP1105 workshop "Advances in the synthesis and characterization of nanomaterials for flame retardant applications" COST.MP1105@UGent.be
26-27 March	Vienna, Austria	7th International Symposium on Fire Safety in Railway Systems http://www.railway-network.eu/english/fire-safety-2015.html
30 March – 2 April	Budapest, Hungary	7th European Combustion Meeting http://www.ecm2015.hu
14 April	Safety Harbor, Tampa, Florida	Fire Testing for Codes & Regulations, Marcelo Hirschler (GBH International) mhirschler@gbhinternational.com
15-16 April	Safety Harbor, Tampa, Florida	**► Meeting Flammability Requirements for Commercial Buildings & Construction** (**pinfa-na** and **The National Pollution Prevention Roundtable**) http://www.pinfa-na.org
20-23 April	Cimbra, Portugal	iFireSS 2015 (CIB International Council for Research and Innovation in Building and Construction and Luso-Brazilian Association for Fire Safety ALBRASCI) http://www.ifiress2015.org/home
12-13 May	Denver, Colorado	Fire Retardants in Plastics (AMI) http://www.amiplastics.com/events/event?Code=C648
17-20 May	Stamford, Connecticut	BCC Flame Retardancy Conference (18-20 May) and (17 May) industry seminar http://www.bccresearch.com/conference/flame
18-19 May	Guangzhou, China	International Flame Retardancy and Compounding Conference – on www.skz.de soon
16-18 June	Nicosia, Cyprus	2nd European Symposium of Fire Safety Science http://www.iafss.org/2nd-european-symposium-of-fire-safety-science/
22-25 June	Berlin, Germany	►FRPM 15th European Meeting on Fire Retardancy and Protection of Materials http://www.frpm2015.bam.de/en/home/index.htm
19-22 July	Beijing	10th Asia-pacific Conference on Combustion http://www.cce.tsinghua.edu.cn/aspacc2015
28-30 Sept	Cambridge, UK	6th International Symposium Human Behaviour in Fire http://www.intersciencecomms.co.uk/html/conferences/hb/hb15/hb15.htm
5-7 Oct 2015	New Delhi	Fire India http://www.fire-india.com/
5-7 Oct 2015	Tsukuba, Japan	10th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) http://www.iafss.org/10th-aosfst/

***Publisher information**: This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.*
***Abbreviations**: See pinfa website: http://www.pinfa.eu/library/glossary-of-abbreviations.html*

pinfa

Newsletter for non-halogen fire safety solutions

March 2015 – N° 50

Innovation

Flammability requirements for commercial buildings

15-16 April – Tampa – Florida

Meeting Flammability Requirements for Commercial Buildings & Construction April 15-16, Tampa, Florida	One-day course (GBH International) "Fire Testing for Codes & Regulations" April 14, Tampa, Florida

pinfa-na Phosphorus, Inorganic & Nitrogen Flame Retardants Association

SAFETY HARBOR RESORT AND SPA

National Pollution Prevention Roundtable

Speakers include: Clean Production Action, Underwriters Laboratory, General Cable Company, US Green Building Council, US EPA, PolyOne Corporation, Communications Cable & Connectivity Association, Eastman Chemical Co., Keller Products Inc., Firestone Building Products, as well as R&D experts and flame retardant industry leaders.

"Meeting Flammability Requirements for Commercial Buildings & Construction", 15-16 April 2015,
"Fire Testing for Codes & Regulations", one day course, 14 April, Safety Harbor, Tampa Bay, Florida.
Link to press release – up to date version on Programme: http://www.pinfa-na.org
Registration: http://events.r20.constantcontact.com/register/event?llr=ccdjsljab&oeidk=a07ea1o6uwwcfcd8bf5&oseq

Without FRs, today's fires are "bigger, stronger, faster"

US research and fire safety testing organisations are working together to understand how fires develop in today's buildings, carrying out more than 200 structural fire experiments. The website http://modernfirebehavior.com/ provides a portal to the research results and conclusions for fire-fighting tactics. The researchers say "*Fires today can develop more aggressively and potentially pose more dangers than just a few decades ago … largely because construction materials and contents can be much more volatile than they used to be*". Furniture and bedding are cited as today being fast-burning, energy-rich and highly combustible, as shown in a video from Underwriters Laboratories. The researchers state "*Pound for pound, the energy rate has increased three or four times*". They note that fire danger is further accentuated because modern homes are very well insulated with little air entry, so that fires burn slowly with low oxygen producing thick black smoke, and can suddenly go to flashover in 30 seconds if a door or window is opened.

http://ModernFireBehavior.com is a joint effort of www.FirefighterCloseCalls.com and the Underwriters Laboratories Fire Safety Research Institute http://ulfirefightersafety.com/

Video "Comparison of room furnishings: legacy room, modern room", Underwriters Laboratories 2011 https://www.youtube.com/watch?v=mulnwTNhV6Q

"New Fires, New Tactics – as modern furnishings and construction methods lead to bigger, more aggressive fires, a wealth of new research is leading the fire service to re-examine fundamental practices for fighting residential fires", J. Roman, NFPA Journal Jan/Feb 2015 http://www.nfpa.org/newsandpublications/nfpa-journal/2015/january-february-2015/features/fire-tactics

ModernFireBehaviour – An informational clearinghouse of modern fire behaviour research coupled with modern day tactics http://modernfirebehavior.com/

GIMV – Ecochem PIN FR treatment of wood composite panels

EcoChem International (www.ecochem.be), a portfolio company of the GIMV Group Belgium, uses non halogen flame retardants to achieve fire safety performance in wood / timber products such as chipboard, MDF panels, OSB-boards and plywood. Applications include furniture, interior & exterior construction materials, used mainly in public buildings such as hotels, hospitals, schools, etc. The PIN fire-protection products are added during the wood panel production process, and perform to achieve FR standards such as EN 13501 Class B/C or US ASTM E84 Class 1 / A. Ecochem also offers a wide range of PIN flame retardants for natural thermal insulation materials, paper, cellulose, plastics and polymers, thermosets – resins, textiles and coatings and sealants. EcoChem recently joined the GIMV Group, a European investment company specialised in consumer innovation products, health & care, smart industries and sustainable cities. The group sees PIN FR fire safety as a "future orientated niche in speciality chemicals" within its Sustainable Cities platform.

Source www.ecochem.be   MDF = medium density fibre. OSB = oriented strand boards.

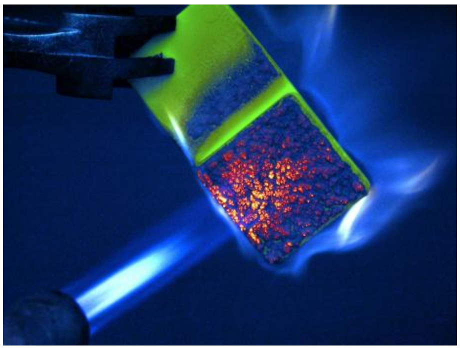
"Gimv invests in specialty chemicals formulator EcoChem International", 12 Nov. 2014 http://www.ecochem.be/images/documents/PR%20EcoChem_12112014_ENG.pdf

PIN FR film for LEDs and performance applications

Teijin DuPont Films Japan has launched new PIN FR films for electronics, construction, and performance applications. The company states "*Halogenated flame retardants are not used, eliminating related concerns regarding environmental impact and human health*". The new PET (Polyethylene terephthalate) film, Tetoron UF, targets electronics and other performance applications, including LED lighting (the film offers high reflectance properties), as well as in substrates for flexible electronic displays, computers and office equipment and electronics parts labels. Tetoron UF offers fire performance equivalent to UL VTM-0, heat and chemical resistance and strength. The company claims it is up to ten times cheaper than polyamides often used to achieve comparable levels of performance. Teijin DuPont's PEN (polyethylene napthalate) film, Teonex Q, achieves VTM-0 self-extinguishing within 10 seconds and offers excellent strength and heat resistance because of the proprietary PIN flame retardant. Applications include lithium ion batteries, flexible printed circuit boards, flat cables, lighting and construction materials.

Teijin press release "Teijin DuPont Films Develops World-class Flame-retardant Film", 7/4/2014
http://www.teijin.com/news/2014/ebd140407_25.html
Teijin press release polyester films "Teijin DuPont Films Develops World-class Flame-retardant Polyester Film" 22/10/2014 http://www.teijin.com/news/2014/ebd141022_25.html
Teijin DuPont Films technical data PET films http://www.teijindupontfilms.jp/english/product/pet_tef.html and Teonex http://www.teijindupontfilms.jp/english/product/pen_teo.html

PIN flame retardant TPEs for transport applications



Müller Kunststoffe, part of HEXPOL TPE, the global thermoplastic elastomer (TPE) compounding group, has developed the Lifoflex® FLAM range of flame retardant TPE compounds. The Lifoflex FLAM 700 series fulfils the demanding flame retardant materials specifications and can be used for railroad applications (e.g. for profiles, cable grommets, connectors, electrical insulation). DIN 5510-2-2009-05 and DIN EN 5659-2 testing results show conformity for rail applications (flammability S3, drip formation ST2, smoke formation SR2, fume toxicity FED (fractional effective dose) classification 0.14 at tzul 30 min). The Lifoflex FLAM TPE compounds are halogen and antimony oxide free, ensuring low corrosion and toxicity of gases in case of fire. Performance characteristics are flexibility, processing and adhesion to technical polymers and thermoplastics, with flame retardancy of UL 94 V0 at 3.0 and 1.5 mm.

"HEXPOL TPE presents high performance TPE solutions for essential industries at Fakuma 2014"
http://www.hexpoltpe.com/en/news.htm?id=274 and Lifoflex® FLAM flame retardant TPE compounds specifications http://www.hexpoltpe.com/en/lifoflex-flam.htm

PIN flame retardants in flexible polyurethane foam

Polyurethane foams are increasingly used in furniture, transport applications and in building materials, for seats and cushions, mattresses, insulation, sound and vibration damping and shaping forms. However, these foams post an inherent high fire risk. Burning occurs in two stages: a solid phase, with yellow smoke including HCN, and then a liquid burning pool stage, generating considerable heat and toxic carbon monoxide. An increasing range of PIN flame retardants are being developed for polyurethane foams. N. Usta showed that power station fly ash combined with ammonium polyphosphate improved both fire resistance

and thermal stability of rigid polyurethane foam. Yingjie et al. compared 10% loading of a phosphorus-nitrogen PIN FR (MPOP triazine triamine phosphate) to 10% loading of brominated flame retardant (HBB/TBECH), showing that the PIN FRs achieved a slightly lower peak heat release than the brominated FRs (271 vs. 284 Kw/m^2, compared to over 600 kW/m^2 for non-treated foam) and that the brominated FR treated foam had higher smoke toxicity, reaching WX class toxicity (mice comatose) for brominated FR loading > 4%.

"Investigation of Fire Behavior of Rigid Polyurethane Foams Containing Fly Ash and Intumescent Flame Retardant by Using a Cone Calorimeter", N. Usta, J. Applied Polymer Science, 124(4), 3372-3382, 2012 http://onlinelibrary.wiley.com/doi/10.1002/app.35352/abstract

"The effect of flame retardant additives on the combustion performance of flexible polyurethane foam", C. Yingjie, Bulgarian Chemical Communications, Volume 46, Number 4 (pp. 882 – 886) 2014 http://bcc.bas.bg/BCC_Volumes/Volume_46_Number_4_2014/Chien-46-4-882-886.pdf

Development perspectives for PIN FRs

An article in Kunstoffe Internationale summarises developments and R&D into flame retardants, emphasising the demand for "*eco-friendly*" fire safety solutions, with non-halogenated and polymeric FRs driving innovation. Flame retardant demand is expected to continue to grow 5% per year as a result of plastics growth and stricter safety requirements. The response will be products with a high safety standard, "*especially halogen-free*". The majority of current research is in China (61%), followed by Japan and Korea. The article particularly examines developments in the following: polyamides where 50% of formulations are expected PIN FR based in the future, polysters using phosphorus-based PIN FRs, polycarbonates using FR alternatives to bisphenol-A based substances (eg. TBBPA) and polyolefins with new low-loading PIN FR systems, polystyrene foam FR alternatives to HBCD, PIN FR epoxy resins for lightweight composites, reactive FRs for polyurethane foams. The author identifies lower FR loadings and toxicological safety as key development objectives, with oligomeric, polymeric and reactive FRs offering important potential.

"Eco-friendly fire prevention: new developments in flame retardants", R. Pfaendner, Fraunhofer Institute for Structural Durability and System Reliability, in Kunstoffe Internaional 8/2014 https://www.kunststoffe.de/en/journal/archive/article/new-developments-in-flame-retardants-881635.html *or read online* http://issuu.com/fraunhoferlbf/docs/fraunhofer_lbf_kuint_2014_8_s48ff_/0

See also: "Are halogens really necessary", A. Beard, Clariant, Kunstoffe International 2/2013 http://www.flameretardants-online.com/images/userdata/pdf/374_EN.pdf

Fire retardant fibreglass cable support system

Oglaend Systems, Norway, has developed a non-halogenated flame retardant fibre-glass range of cable supports, ladders and trays. The FRP range offers lightweight and compact (flat) packaging for shipping and full compatibility with ETIN tubing clamps and SmartCleat fitting systems. Ladders conform to NEMA 20C. The system offers higher strength on a weight to weight ratio than steel supports, is impact, ultraviolet and corrosion resistant, and offers the advantage of being non-conductive and electro-magnetically transparent, improving electrical safety and performance. The fibreglass system components offer fire safety performance tested to ASTM-E (class 1 & BS476 part 7 class I & II) and are self extinguishing to UL94 V-0 (under ASTM-D 635). The system products are rated Zero Halogen to IEC60754.

Source: http://www.oglaend-system.com/products/frp/frp-system-fibreglass *and* http://www.oglaend-system.com/products/frp/product-features-tray-ladder/product-features-tray-ladder *and* http://www.oglaend-system.com/readimage.aspx?asset=2459

NANOFRABS develops new PIN fire safety solutions for ABS

The EU (FP7-SME) funded project NANOFRABS has demonstrated the synergies between nano-clay (MMT montmorillonite) or minerals (LDH layered double hydroxides) and PIN flame retardants (based on phosphorus and/or nitrogen) to provide fire protection for ABS polymer (acrylonitrile-butadiene-styrene, which is widely used for its performance physical properties, in particular in the electric appliances sector). The modified fillers have shown to distribute well in the ABS polymer matrix and to offer high processing temperature stability. Fire performance of UL94-V0 (3.2mm) and V2 (1.6mm) has been achieved by combining the fillers with an ammonium phosphate based PIN flame retardant (Exolit® AP 766), but FR loadings need to be optimised to avoid polymer performance issues.

NANOFRABS "Halogen Free Flame Retardant ABS nanocomposites for electric and electronic devices", EU 7th Framework Programme SME project, 1st project report summary, 12/2014, European Commission R&D Information Service (CORDIS) http://cordis.europa.eu/project/rcn/105435_en.html *See also pinfa Newsletter n° 29*

PIN FR solutions for polylactic acid biopolymers

Polylactic acid (PLA) is a biodegradable thermoplastic polymer produced from bio-resources such as corn starch, tapioca roots or sugarcane. However, the polymer is highly flammable and susceptible to dripping and brings the risk of spreading fire. Different PIN flame retardants have already been shown to be effective in polylactic acid polymers and blends (see pinfa Newsletter n°29). Bocz et al. tested ammonium polyphosphate and natural clay (montmorillonite) in all-PLA composites, produced by combining crystalline PLA fibres with amorphous PLA films. 16% PIN FR loading enabled a 40-50% reduction in peak heat release and total heat emission achieving UL94 V0 fire safety rating and enabling the polymer to be self-extinguishing. With 33% FR dosing, dripping was fully suppressed. The PIN FR loading in the PLA did not significantly decrease the tensile and flexural strength of the polymer composite (probably because the PLA fibres were not modified), and increased stiffness, impact resistance and temperature dependent storage modulus. The PIN FRs tested were Clariant Exolit® AP 462, a micro-encapsulated ammonium polyphosphate (APP), and Rockwool Nanfil® 116, a non-treated montmorillonite (MMT). The authors note that this phosphorus PIN FRs is non-toxic and degrades to harmless plant nutrients.

"Flame retarded self-reinforced poly(lactic acid) composites of outstanding impact resistance", K. Bocz et al., Budapest University of Technology and Economics, Composites: Part A 70 (2015) 27–34 http://dx.doi.org/10.1016/j.compositesa.2014.12.005

Washington State report on flame retardants

Washington State has published a report reviewing information on flame retardants, following a 2014 State legislature mandate. The report concludes that "*All halogenated flame retardants evaluated to date exhibit toxicity. Types of toxicity associated with known halogenated flame retardants include endocrine and reproductive effects, carcinogenicity, and neurological and developmental disorders*". Two brominated FRs (TBBPA and HBCD) are flagged in the report summary as having possible significant health risks (TBBPA: moderate carcinogenicity and breakdown to bisphenol A; HBCD: possible liver, thyroid, reproductive and development effects). The PIN FRs ammonium polyphosphate, polyphosphate and magnesium hydroxide are flagged as safer alternatives. The report recommends restricting the use of ten flame retardants in children's products and in furniture (unless chemically reacted into the product): 8 halogenated FRs (TDCPP, TCPP, TBPH, V6, TCEP, TBB, TBBPA and HBCD and two phenyl phosphates (TPP and iPTPP). The report underlines that further study is needed to assess the availability of safer alternatives.

"Flame Retardants - A Report to the Legislature", State of Washington Department of Ecology, December 2014, publication n° 14-04-047 https://fortress.wa.gov/ecy/publications/SummaryPages/1404047.html

Non-halogenated FR market predicted to grow 7% annually

The global non-halogenated flame retardant market for polymers is predicted to grow 67% (value) from 2011 to 2018, to reach US$ 2.15 billion in 2018 (7.1% market growth per year), according to two market reports published by Transparency Market Research. Increasing polymer use in a range of industries, demand for flame retardant polymers to contribute to fire safety and a move to non-halogenated flame retardants by user industries because of concerns for halogenated products are cited as expected to drive the market. Issues for non halogenated flame retardants are considered to be high loading levels and processability. Transportation, textile, construction, electrical and furniture are cited as key applications, with particularly strong development expected for engineering thermoplastics.

"Non-Halogenated Flame Retardants Market to Reach US$2.15 Billion by 2018", TransparencyMarketResearch, 14th January 2015 http://www.transparencymarketresearch.com/pressrelease/non-halogenated-flame-retardants.htm

"Flame Retardant Chemicals Market - Global Industry Analysis, Size, Share, Growth, Trends And Forecast, 2012 – 2018" http://www.transparencymarketresearch.com/flame-retardant-chemicals.html

"Non-Halogenated Flame Retardants (Aluminum Hydroxide, Phosphorus and Others) Market for Polymers (Polyolefin, Epoxy Resin, PVC, ETP, UPE, Rubber, Styrenics and Others) - Global Industry Analysis, Size, Share, Growth and Forecast, 2012 – 2018" http://www.transparencymarketresearch.com/non-halogenated-flame-retardants.html

Other news

China industrial organophosphorus FR discharges: analysis of 12 organophosphorus flame retardants and industrial production intermediates in 40 rivers entering the Bohai Sea, China: 3 chlorinated alkyl phosphates (TCPP, TCEP, TDCPP), 8 non-halogenated alkyl phosphates (TiBP, TBP, TBEP, THP, TPeP, TEHP), 2 non halogenated aryl phosphates (TPP, TCP) and the industrial intermediate TPPO. The most abundantly found substances were halogenated FRs (TCPP, TCEP), probably from the same source. The authors identify these two FRs, along with the intermediate TPPO as priority substances to address emissions, emphasising that the region is heavily industrialised and suggest that the pollution is probably from chemical manufacturing plants in the river basins.

"Occurrence and spatial distribution of organophosphate ester flame retardants and plasticizers in 40 rivers draining into the Bohai Sea, north China", R. Wang et al., Environmental Pollution 198 (2015) 172-178 http://dx.doi.org/10.1016/j.envpol.2014.12.037

Aryl and alkyl phosphorus FRs: in a recent publication, 9 organophosphorus FRs were tested, of which 3 were chlorinated (TCEP, TCPP, TDCPP), 4 aryl phosphates (TBP, TBEP, TPrP, TEP) and 2 alkyl phosphates (TPhP, CDP). Acute aquatic toxicity on fish embryos showed to correlate to hydrophobicity. The 2 alkyl phosphates were also tested for developmental effects, with CDP (cresyl diphenyl phosphate) showing more serious impacts.

"Aryl organophosphate flame retardants induced cardiotoxicity during zebrafish embryogenesis: by disturbing expression of the transcriptional regulators", Z. Du et al., Aquatic Toxicology 161 (2015) 25-32.

KEMI recommendations for REACH: The Swedish Chemicals Agency, KEMI, has published proposals for developing REACH, the European Chemicals Regulation, and its implementation. This is in response to a Swedish Government mandate. The Agency "*considers REACH to be a major step forward in the protection of health and the environment*" and underlines that developments should include chemicals policy definition as well as technical implementation. The agency proposes to better manage the risks of groups of chemicals and expresses concern that substitution of high-risk chemicals should not be by closely related chemicals with similar hazardous properties, considering that "This has happened, for example, in the groups of brominated flame retardants".

"Developing REACH and improving its efficiency - an action plan", KEMI Swedish Chemicals Agency Report 2/15 ISSN 0284-1185: http://www.kemi.se/Documents/Publikationer/Trycksaker/Rapporter/Report-2-15-REACH.pdf

EPA database of chemicals and usages: The US Environmental Protection Agency online data base, CPCat, groups data categorising the uses and functions of more than 43 000 chemicals, as presented recently by Dionisio et al. The objective is to provide information to support prioritisation of assessment of human exposure potential for chemicals.

"Exploring Consumer Exposure Pathways and Patterns of Use for Chemicals in the Environment", K. Dionisio, Environment, Toxicol. Rep. (2015), http://dx.doi.org/doi:10.1016/j.toxrep.2014.12.009

Agenda

Events with active pinfa - pinfa-na participation are marked: ►

3 March	Online	Online Course: Halogen-free Flame Retardants: Optimal Selection for better Performance http://omnexus.specialchem.com/online-course/1118
11-12 March	St. Avold, Moselle, France	Matching fire retardant solutions to industrial constraints, French Chemicals Association (SCF) http://plastinnov.blogspot.fr/2014/12/adequation-entre-solutions-retard-au.html
18-19 March	Würzburg, Germany	Trends in Fire Safety and Innovative Flame Retardants for Plastics http://www.skz.de/de/weiterbildung/fachtagungen/lehr_/Trends_in_Fire_Safety_and_Innovative/108..html?detID=7431
18-19 March	Cologne, Germany	Green Polymer Chemistry 2015 www.amiplastics.com/events/event?Code=C637
18-19 March	Berlin, Germany	Fire Protection of Rolling Stock 2015 http://www.arena-international.com/fprs/
26-27 March	Bucharest, Romania	COST MP1105 workshop "Advances in the synthesis and characterization of nanomaterials for flame retardant applications" COST.MP1105@UGent.be
26-27 March	Vienna, Austria	7th International Symposium on Fire Safety in Railway Systems http://www.railway-network.eu/english/fire-safety-2015.html
30 March – 2 April	Budapest, Hungary	7th European Combustion Meeting http://www.ecm2015.hu
14 April	Safety Harbor, Tampa, Florida	Fire Testing for Codes & Regulations, Marcelo Hirschler (GBH International) mhirschler@gbhinternational.com
15-16 April	Safety Harbor, Tampa, Florida	**► Meeting Flammability Requirements for Commercial Buildings & Construction** (**pinfa-na** and **The National Pollution Prevention Roundtable**) http://www.pinfa-na.org
20-23 April	Cimbra, Portugal	iFireSS 2015 (CIB International Council for Research and Innovation in Building and Construction and Luso-Brazilian Association for Fire Safety ALBRASCI) http://www.ifiress2015.org/home
12-13 May	Denver, Colorado	Fire Retardants in Plastics (AMI) http://www.amiplastics.com/events/event?Code=C648
17-20 May	Stamford, Connecticut	BCC Flame Retardancy Conference (18-20 May) and (17 May) industry seminar http://www.bccresearch.com/conference/flame
18-19 May	Guangzhou, China	International Flame Retardancy and Compounding Conference – on www.skz.de soon
16-18 June	Nicosia, Cyprus	2nd European Symposium of Fire Safety Science http://www.iafss.org/2nd-european-symposium-of-fire-safety-science/
22-25 June	Berlin, Germany	►FRPM 15th European Meeting on Fire Retardancy and Protection of Materials http://www.frpm2015.bam.de/en/home/index.htm
19-22 July	Beijing	10th Asia-pacific Conference on Combustion http://www.cce.tsinghua.edu.cn/aspacc2015
28-30 Sept	Cambridge, UK	6th International Symposium Human Behaviour in Fire http://www.intersciencecomms.co.uk/html/conferences/hb/hb15/hb15.htm
5-7 Oct 2015	New Delhi	Fire India http://www.fire-india.com/
5-7 Oct 2015	Tsukuba, Japan	10th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) http://www.iafss.org/10th-aosfst/

***Publisher information**: This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.*
***Abbreviations**: See pinfa website: http://www.pinfa.eu/library/glossary-of-abbreviations.html*

pinfa

Newsletter for non-halogen fire safety solutions

April 2015 – N° 51

Flammability requirements for commercial buildings

15-16 April – Tampa – Florida

Meeting Flammability Requirements for Commercial Buildings & Construction April 15-16, Tampa, Florida	One-day course (GBH International) "Fire Testing for Codes & Regulations" April 14, Tampa, Florida

pinfa-na Phosphorus, Inorganic & Nitrogen Flame Retardants Association

Safety Harbor Resort and Spa

National Pollution Prevention Roundtable

Speakers include: Clean Production Action, Underwriters Laboratory, General Cable Company, US Green Building Council, US EPA, PolyOne Corporation, Communications Cable & Connectivity Association, Eastman Chemical Co., Keller Products Inc., Firestone Building Products, as well as R&D experts and flame retardant industry leaders.

"Meeting Flammability Requirements for Commercial Buildings & Construction", 15-16 April 2015,
"Fire Testing for Codes & Regulations", one day course, 14 April, Safety Harbor, Tampa Bay, Florida.
Link to press release – up to date version on Programme: http://www.pinfa-na.org
Registration: http://events.r20.constantcontact.com/register/event?llr=ccdjsljab&oeidk=a07ea1o6uwwcfcd8bf5&oseq

Fire safety standards show their effectiveness

No news is good news … Two recent examples show how stringent fire safety standards can contribute to avoiding tragedy.

- A spark from a light on a theatre curtain in Stiefel Theatre, Salina, Kansas, 12/2/2015, caused it to smolder and char a hole, but it did not ignite. The curtain was flame retarded conform to standards for public entertainment venues.
- A fire broke out in the overhead cabin baggage rack on the KLM Amsterdam-Bangkok flight as the plane was taxiing after landing, apparently caused by a lithium ion battery in a drone in a passenger's luggage. Cabin attendants put the fire out with on-board fire extinguishers. Aircraft safety standards set very high fire resistance requirements for the plastics and other materials used in aircraft interiors.

"Spark from light chars hole in Stiefel Theatre stage curtain", Salina Journal, 12/2/2045 http://www.salina.com/news/local_briefs/spark-from-light-chars-hole-in-stiefel-theatre-stage-curtain/article_13752bd7-b3ef-5c8f-98db-3d68925d1d97.html

"Dramatic moment KLM flight attendant extinguished fire 'caused by lithium ion battery in passenger's hand luggage' on flight from Amsterdam to Bangkok" 16/3/15 http://www.dailymail.co.uk/travel/travel_news/article-2995699/Small-fire-breaks-KLM-flight-Amsterdam-Bangkok.html

Tracee Jackson cover story in International Environmentalist

pinfa member FRX Polymers have launched a series of blog videos: "The Life and Times of Tracee Jackson", the story of the dynamic fictional CEO of a company coincidentally called FRX Polymers. Tracee introduces FRX Polymers' Nofia flame retardant. "*The best synthetics have Nofia*" she says, using the example of synthetic hair. Natural hair does not burn readily (because of P and N in its protein structure) whereas synthetic fibres are highly flammable. Nofia is a non-toxic and non-bioaccumulative, phosphorus-based PIN flame retardant. In 2014, FRX received the USA EPA (Environmental Protection Agency) Environmental Merit Award for "*making products that reduce risks to human health and reduce environmental damage*" and for developing "*safer alternatives to toxic, persistent brominated flame retardants, providing many industries with a safer solution for their product needs*." Tracee Jackson tells her contacts that "*No one wants to think about their hair being on fire*" and shows how non-FR synthetic hair burns violently whereas Nofia hair self-extinguishes.

The Life and Times of Tracee Jackson "What is good synthetic hair" http://whatisgoodhair.com/index.php

"FRX Polymers Receives Environmental Protection Agency (EPA) Award" http://www.businesswire.com/news/home/20140624005772/en/FRX-Polymers-Receives-Environmental-Protection-Agency-EPA#.VQ_DZWdFBbU

TCO Certified Displays 7 draft criteria

TCO Certified Displays 7
Draft open for comments

TCO, the health, environment and worker protection label, has published draft updated criteria for Flat Panel Displays (FPD Certified Displays 7), which is open for comments until 19th May. The criterial focus on "sustainability throughout the product life cycle" and target in particular buyers under the EU Public Purchasing Directive 2014. The proposal ($A.6.4.2) excludes all halogenated flame retardants and halogenated plastics from plastic parts (parts > 25g), including LCD panels. PIN flame retardants are authorised, subject to having a GreenScreen assessment with benchmark 2 or higher (see pinfa Newsletter n° 41). This follows the TCO decision to authorise a number of PIN flame retardants in all IT product categories (see pinfa Newsletter n° 44).

TCO "Update – Criteria review, non-halogenated substances" 14/4/2014 http://tcodevelopment.com/news/criteria-review-non-halogenated-substances-pre-draft-open-for-comment/

"TCO Certified Accepted Substances List" 16/4/2014 http://tcodevelopment.com/files/2014/04/2014-04-16-TCO_Certified_Accepted_Substance_List.pdf

"TCO Certified Displays 7. Draft open for comments. New Generation criteria draft out now!" http://newsletter.paloma.se/webversion/default.aspx?cid=5266&mid=281684

New UL/ANSI circuit board types recognise PIN technology

UL (Underwriters Laboratories) have recognised the evolution of today's performance fire-safety treated materials for printed circuit boards (PCBs) by splitting the UL/ANSI (American National Standards Institute) FR-4 specification into two, FR4-0 for the traditional brominated PCBs and FR 4.1 for the more recent PIN ("non-halogen") materials. Originally FR-4 PCBs were glass-filled brominated epoxies, but they have been improved to ensure high speed and high reliability, as well as to respond to market demand for environmental, non-halogenated materials. Both types of FR-4 board must contain at least 50 wt% epoxy resin, 45 wt% inorganics and meet a 130°C thermal rating. The new FR-4.1 boards must contain < 900 ppm chlorine, < 900 ppm bromine and < 1500 ppm total halogens.

"What does UL's FR-4 Reclassification Mean to Your Company?" http://www.thetestlab.com/uls-fr-4-reclassification-mean-company/

UL slides: http://www.ul.com/global/documents/offerings/industries/hightech/printedwiringboards/2013_FR4_IPC_Impact-20130602.pdf

"New AL/ANSI types replacing FR-4 from IPC proposal", The PCB Magazine, March 2015 http://www.pcb007.com/pages/thepcbmagazine.cgi

PIN flame retarded optical fibre jackets for public buildings

Evonik Industries AG's has launched Vestodur® X9426, a new non-halogenated flame retardant grade for optic fibre cable jacketing and wire bundles, meeting demanding requirements increasingly fixed in public construction project tenders. The PIN flame retardant PBT (polybutylene terephthalate) offers high fire resistance, low smoke density and low smoke toxicity. VESTODUR fulfils flammability class according to UL94 (IEC 60695) V-2 at 0.8 mm. The extruded material offers flexibility, kink and crush resistance and good hydrolysis properties.

Source: http://corporate.evonik.com/en/media/press_releases/pages/news-details.aspx?newsid=50063

PIN textile flame retardant achieves OEKO-TEX 100 compliance

Archroma's Pekoflam® HFC is the first powder flame retardant for textile coating to be listed under the OEKO-TEX 100 Ecolabel. The non-halogenated* PIN flame retardant is an organic phosphorus – nitrogen based compound which can be used in water-based systems. It offers high performance on synthetic fibres including polyamides and blends, and is adapted for demanding applications such as military and protective clothing, transport interior textiles and high-quality upholstery. The compatibility with water-based systems as well as OEKO-TEX®+ Standard 100 compliant solvent-based coating systems ensures flexibility to different application technologies and end-uses. Properties are compatible with direct skin contact applications. Pekoflam® HLC adds to the existing range of Pekoflam® MSP and Pekoflam ECO and SYN as non-halogenated* fire retardants, which are also compliant* with OEKO-TEX restricted substances and are particularly adapted for cotton textiles, offering high efficacy and low impact on textile tensile strength.

Photo: Shutterstock. Archroma Pekoflam® ECO/SYN http://textiles.archroma.com/pekoflam-ecosyn/ "Archroma's Pekoflam® HFC is first powder based flame retardant additive for coating applications to be listed with OEKO-TEX Standard 100", 10th March 2015 http://archroma.com/news-releases/march-10-2015-archromas-pekoflam-hfc-is-first-powder-based-flame-retardant-additive-for-coating-applications-to-be-listed-with-oeko-tex-standard-100/

PIN flame retardant cables for cleanroom environments

HELUKABEL offers a range of high performance, high quality, PIN flame-retardant cables for the particularly challenging application of "cleanrooms", such as semiconductor and electronics manufacturing facilities where even the smallest contamination, particle or dust can damage production. The cables are flame retardant and low smoke halogen free (LSZH), as well as resistant to oils, light, chemicals, solvents, radiation, mechanical stress and temperatures of -40°C - +80°C. The cables are also safe for food contact. Quality for use in cleanrooms is certified by the Fraunhofer Institute for Production Techniques and Automation. *Source:* http://www.helukabel.de/us/us/industries/electronics/cleanflex_hf_1.html

Voltatex® 4080 impregnating resin

Axalta Coating Systems recently announced the launch of a new halogen-free, flame retardant impregnating resin with outstanding flame retardance, Voltatex® 4080. This newly-developed material is specially designed for dry-type transformer application, and features excellent PIN flame retardant technology (LOI > 30, by UL94 combustion level test). This secondary insulation material allows safer operation of the resulting electric device without risks of release of halogenated compounds in case of fire. The development of electrical insulation materials has been a strength of Axalta's research and development. The continual evolution of Axalta's product offering is the result of the on-going exchange of know-how with leading manufacturers in the electrical and electronics industry.

http://www.axaltacs.com/corporate/en_US/newsroom/news-releases/next-generation-products.html

PTS and Eurostar offer PIN polyamide range

Polymer Technology & Services (PTS) has signed a collaboration agreement with Eurostar Engineering Plastics to design and manufacture Starflam flame retardant polyamides for the North America electronics, automobile and renewable energies markets. Eurostar offer a wide range of Starflam ECO-FR, XGEN non-halogenated polyamides, offering high performance (impact, tight tolerance, elongation, modulus, comparative tracking index, relative temperature index) with flame retardancy in the V-2 to V-0 range at 0.4 mm and 5VB - 5VA, UL746C class F1. Transport range XGEN products achieve the DIN 5510 transportation standard. Applications for the Starflam PIN flame retardants include automobile, mass transport (metro, trains), electronics, photovoltaics and industry.




"Polymer Technology to manufacture and sell Eurostar plastic compounds", October 2014 http://www.eurostar-ep.com/en-us/starflam-usa.aspx

"Starflam High Performance Halogen Free Polyamides" http://www.eurostar-ep.com/en-us/news/12-138/starflamhalogenfree.aspx

Industry presses for EU tourism fire safety Directive

Euralarm, the electronic fire and security industry association, wants an EU Directive on Fire Safety and Security for Tourism Accommodations, supported by EU standards (CEN, CENELEC). The industry organisation reminds that Europe is the world's number one tourist destination, but today has no horizontal legislation to ensure coherent fire safety in tourism accommodation. "*Safe exit times are lower than 20 years ago, because fire spreads faster. To improve fire safety, Euralarm believes that an European Commission Directive should require Member States to implement national legislation on fire safety and security in hotels fulfilling minimum requirements established at EU level*." Specific attention should be paid to the risk populations, including the elderly and children.

"Euralarm proposes EU Directive on Fire safety and security for tourism accommodations", IFP Magazine, February 2015 http://ifpmag.mdmpublishing.com/euralarm-proposes-eu-directive-on-fire-safety-and-security-for-tourism-accommodations/ and Euralarm https://www.euralarm.org/media/press/releases/2015-02-09-euralarm-proposes-eu-directive-fire-safety-and-security-tourism-accommodations.pdf

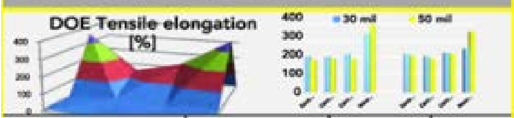
PIN FR for polypropylene fibres in different textile structures

PIN flame retardant polypropylene masterbatches were developed and tested for producing different textiles, combining phosphorus, inorganic and nitrogen components (inorganic aluminium phosphinate, phosphate ester, melamine cyanurate). Different ratios of the PIN FR components were tested for a total FR loading of 6%, in nonwoven and in knitted fabrics. The thickness and textile structure significantly modified fire behaviour, with thicker structures showing lower fire performance because of opening up in contact with a flame. With an inorganic phosphinate / melamine ratio of 2:1, significantly improved LOI and cone calorimeter fire performances were obtained, and nonwoven 200 g/m^2 polypropylene textiles achieved FMVSS302 and DIN 4102-1 standards.

"Development of a Halogen Free Flame Retardant Masterbatch for Polypropylene Fibers", F. Rault, Polymers 2015, 7, 220-234 www.mdpi.com/journal/polymers

SACO Polymers innovative tray cable jacketing

Cable physical properties



Cable jacket* material	UL1581 90°C FRPE	MFB 1	MDH only
% retention tensile strength	85	100	110
% retention tensile elongation	50	90	120
Hot deformation (100° C)	<50% decrease thickness	0% Pass	0% Pass
Cold bend -25°C	No visual damage	Pass	Pass

SACO Polymers, a market leader in wire and cable polymer compound solutions, has presented a new high-performance LSZH (low smoke, zero halogen) ceramifiable compound for tray cable jacketing. The technology uses an enhanced filler technology, using (inorganic) PIN flame retardants (magnesium or aluminium hydroxides) combined with synergists (char hardening additives), resulting in improved fire resistance, very low smoke (even with a halogen-containing core material), polymer compound compatibility and optimised cable properties (UL1277 tray cable standards achieved). Minimum char length, near zero smoke and full scale vertical cable test pass were achieved under IEEE 1202/FT4. The new compound enables more flexible tray cable design, for example reduced jacket thickness, elimination of fire-resistant core wrapping tapes and flexible core design. The new material widens the range of highly fire resistant, non-halogenated materials offered by the SACO Group (SACO Polymers, SACO-Macromeric, Aurora, OH, AEI Compounds).

"SACO Polymers launches advanced technology zero-halogen tray cable jacketing compound with enhanced fire performance to meet UL 1277" http://www.sacomacromeric.com/contact/news/december-2014/

"New Low Smoke Zero Halogen Tray Cable Jacket Materials designed for Balance of Cost, Performance and Enhanced Fire Resistance", Z. Ztryczek & D. Roberts, 63rd IWCS Conference, Nov. 2014 http://assets.conferencespot.org/fileserver/file/322619/filename/089_P-22.pdf

Bio-sourced phosphorus ester PIN FRs

Flame-retarding phosphorus esters were produced from bio-sourced raw materials: starch and castor oil. Isosorbide, derived from starch, and 10-undecenoic acid from castor oil were combined with phosphorus to produce four different complex phosphorus compounds. Thermal degradation of these compounds was tested, showing release of phosphorus acid, a known char former in polymers enabling solid-phase fire protection. The phosphates showed easier phosphorus acid release than the phosphonate or phosphinate compounds.

"Thermal degradation of phosphorus esters derived from isosorbide and 10-undecenoic acid", B. Howell & Y. Daniel, J Therm Anal Calorim (Springer), March 2015 http://link.springer.com/article/10.1007/s10973-015-4487-2

Fire safety market will continue to grow

The 'Future Market Insights' industry analysis report 2014-2020 confirms that flame retardants markets will continue to grow, particularly in the Asia-Pacific region, driven by growth in the construction and automotive industries, and by regulations on fire standards. "Eco-friendly" flame retardants are expected to develop particularly in the Asia-Pacific region. A separate report by MarketsandMarkets confirms this expected growth, anticipating a global flame retardant market of 10.3 billion US$ by 2019, again with growth driven by the construction, automotive and consumer goods sectors and particularly in the Asia-Pacific region.

FMI Future Markets Insights "Flame Retardant Chemicals Market - Global Industry Analysis and Opportunity Assessment 2014 – 2020" http://www.futuremarketinsights.com/reports/details/flame-retardant-chemicals-market

MarketsandMarkets "Flame Retardant Market by Type (Aluminum Trihydrate, Antimony Oxide, Brominated, Chlorinated, Organphosphorous) and End-User Industry (Building & Construction, Electronics, Wire & Cables, Automotive) - Global Trends & Forecast to 2019" http://www.marketsandmarkets.com/Market-Reports/flame-retardant-chemicals-market-686.html

EMAS best practices for E&E manufacturing

As defined by the European Eco-Management and Audit Scheme (EMAS) regulation, the European Commission is developing a Sectoral Reference Document (SRD) on Best Environmental Management Practice for the electrical and electronic equipment manufacturing sector (E&E). For pinfa, Bernd Nass of Clariant participated at the Kick Off Meeting, Brussels, 23-24 February 2015. Amongst a range of proposals discussed, was cost-effective and environmentally sound substitution of hazardous substances. The use of GreenScreen® tool was put forward, and a proposal to eliminate brominated flame retardants was discussed controversially. The importance of closed-loop recycling of thermoplastics was highlighted, taking into account the large number of different plastics and additives. The SRD proposals should be finalised by end 2015.

Working documents will be made available at http://susproc.jrc.ec.europa.eu/activities/emas/

Agenda

Events with active pinfa - pinfa-na participation are marked: ►

14 April	Safety Harbor, Tampa, Florida	Fire Testing for Codes & Regulations, Marcelo Hirschler (GBH International) mhirschler@gbhinternational.com
15-16 April	Safety Harbor, Tampa, Florida	**► Meeting Flammability Requirements for Commercial Buildings & Construction** (**pinfa-na** and **The National Pollution Prevention Roundtable**) http://www.pinfa-na.org
20-23 April	Coimbra, Portugal	iFireSS 2015 (CIB International Council for Research and Innovation in Building and Construction and Luso-Brazilian Association for Fire Safety ALBRASCI) http://www.ifiress2015.org/home
29-30 April	Montpelllier, France	COST MP1105 Workshop on "Thermophysical properties, Thermal stability and Fire retardancy of blends and filled polymers" within the Eurofillers/Polymer Blends conference http://eurofillerspolymerblends2015.mines-ales.fr/
12-13 May	Denver, Colorado	Fire Retardants in Plastics (AMI) http://www.amiplastics.com/events/event?Code=C648
17-20 May	Stamford, Connecticut	BCC Flame Retardancy Conference (18-20 May) and (17 May) industry seminar http://www.bccresearch.com/conference/flame
18-19 May	Guangzhou, China	International Flame Retardancy and Compounding Conference – on www.skz.de soon
16-18 June	Nicosia, Cyprus	2nd European Symposium of Fire Safety Science http://www.iafss.org/2nd-european-symposium-of-fire-safety-science/
22-25 June	Berlin, Germany	►FRPM 15th European Meeting on Fire Retardancy and Protection of Materials http://www.frpm2015.bam.de/en/home/index.htm
19-22 July	Beijing	10th Asia-pacific Conference on Combustion http://www.cce.tsinghua.edu.cn/aspacc2015
28-30 Sept	Cambridge, UK	6th International Symposium Human Behaviour in Fire http://www.intersciencecomms.co.uk/html/conferences/hb/hb15/hb15.htm
5-7 Oct 2015	New Delhi	Fire India http://www.fire-india.com/
5-7 Oct 2015	Tsukuba, Japan	10th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) http://www.iafss.org/10th-aosfst/

***Publisher information**: This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.*
***Abbreviations**: See pinfa website: http://www.pinfa.eu/library/glossary-of-abbreviations.html*

pinfa

Newsletter for non-halogen fire safety solutions

May 2015 – N° 52

Sweden proposes VAT penalties for certain flame retardants

Sweden has opened a public consultation (deadline 29th May 2015) on proposals for a tax on consumer electronic goods which contain certain chemicals. The published proposal is c. 13 €/kg for printed circuit boards and plastic parts, with a ceiling of c. 34 € per electronic appliance. 50% / 75% tax reductions are proposed to apply to products which contain no halogenated compounds (additive / reactive) and no "additive phosphorus compounds". pinfa has submitted evidence that this targeting of "additive phosphorus compounds" will be counter-productive, as it will impact effective, safer PIN flame retardants, necessary to achieve fire safety in many polymers. pinfa also emphasises that this wording will also impact simple inorganic phosphorus compounds with no health or environmental impact concern, as well as natural phosphorus-based or bio-based flame retardants.

Sweden Government report on new economic instruments in the area of chemicals, 30th March 2015 and report SOU 2015:30 "Report of the Chemical Tax Commission, Stockholm 2015: chemical tax on certain consumer goods containing chemicals" (in Swedish with English summary) http://www.regeringen.se/sb/d/19734/a/256626

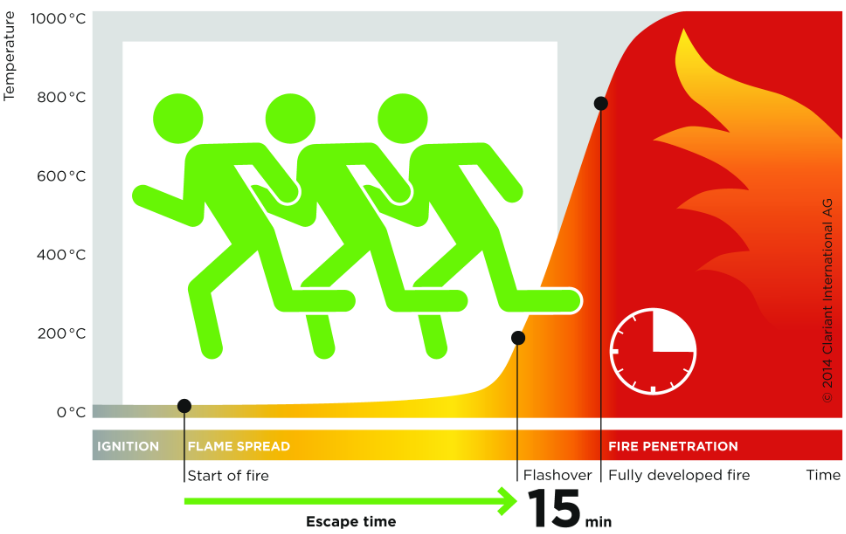
Consultation: fi.registrator@regeringskansliet.se Regeringskansliet, Finansdepartementet, Skatte-och tullavdelningen, Att: Johan Westlund, Jakobsgatan 24, 103 33 Stockholm, Sweden.

Showing how flame retardants save lives

pinfa has a new graphic illustration of “How flame retardants can increase escape time in fires”, see below. The graphs were prepared for pinfa by member company Clariant. They will be used on the new and improved pinfa website currently being prepared, which will be launched this month and are available for use in pinfa presentations and publications (Powerpoint and PDF versions) on request from the pinfa secretariat pinfa@cefic.be

How Flame Retardants can increase escape time in fires

WITH FLAME RETARDANTS



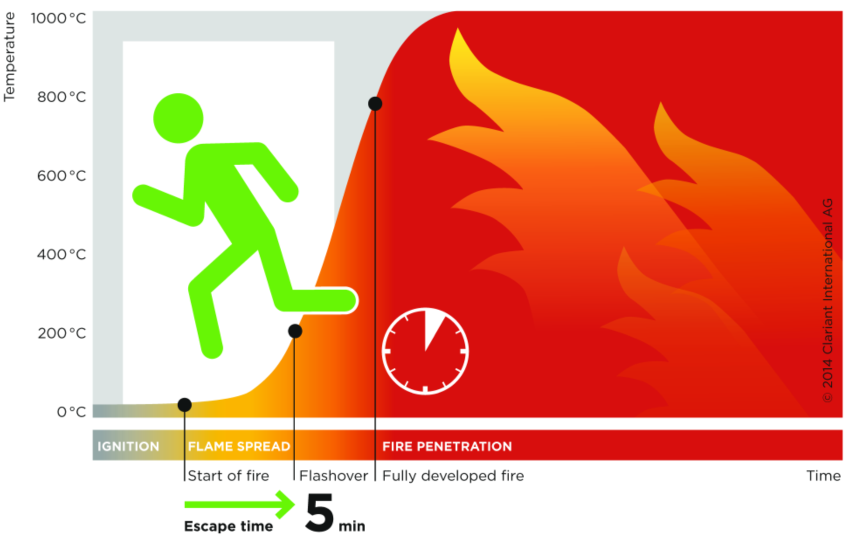
Flame retardants reduce the risk of ignition and fire spread of many plastic and textile materials which results is more available escape time for occupants.

Time to flashover can increase from 5 minutes to 15 minutes which can make the difference between escape and fatalities.

Bear in mind that the escape time includes the time to discover the fire, alert other people, take the decision to call the fire brigade, take own actions to extinguish or take the decision to evacuate the building.

The times and temperatures in the graphs are typical numbers, but can vary according to the circumstances and materials involved.

WITHOUT FLAME RETARDANTS



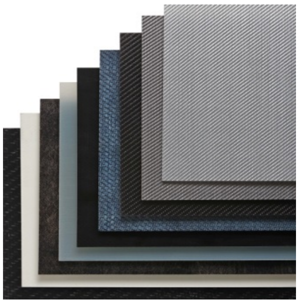
THE 3 PHASES OF FIRE AND THE PROTECTING FEATURES OF FLAME RETARDANTS

Ignition source
· Prevent ignition
· Possibly self-extinguish

Flame spread
· Slow down flame spread
· Reduce heat release
· Delay flash-over

Fire penetration
· Prevent the collaps of structures, e.g. steel columns protected by intumescent coatings
· Prevent fire moving to adjacent room or building compartment

PIN FR composites for performance reinforced polycarbonates



Lanxess (a pinfa member company) has launched a new set of PIN flame retardant, continuous-fibre-reinforced thermoplastic composites with polycarbon matrix. The halogen-free materials offer exceptional flame retardance, achieving UL94 V0 for 0.4 – 2 mm thickness sheets. Composites are available with glass, carbon and glass/carbon fibre reinforcement and fibre volume content of 45-55 %. They offer high mechanical performance, for example flexural modulus of 40 – 54 GPa (carbon fibre) or 20 -24 GPa (glass fibre) and are adapted for production of large items requiring thin-wall and stiff housing parts, such as notebooks, tablets and TV sets.

"LANXESS expands Tepex range of high-performance composites: New continuous fiber-reinforced polycarbonate composites with excellent flame retardance" http://lanxess.com/en/corporate/media/press-releases/trade-technical/2015-00007e/

ADK STAB FP-2000 series performance PIN FR

A pinfa member company ADEKA Corporation in Japan (Amfine Chemical Corporation: ADEKA's subsidiary in the U.S) has launched ADK STAB FP-2000 series, a performance range of phosphorus-nitrogen based (PIN) flame retardants for polyolefins, polypropylene, high and low density polyethylene, ethylene vinyl acetate, etc. The products provide higher flame retardancy by formation of intumescent barriers on the polymer surface, inhibiting combustion, reducing carbon monoxide and smoke emission. They offer low density and high mechanical performance and can be used in outdoor applications without addition of special type of light stabilisers. UL94 5VA can be achieved with suitable synergists. Applications include wiring and cables, construction, transportation, electrical and electronics etc.

Photos: ADEKA Corporation. ADEKA: http://www.adeka.co.jp/en/chemical/index.html

"Amfine Presents New Halogen-Free FR Technology For Polyolefins" http://amfine.com/news/amfine-presents-new-halogen-fr-technology-for-polyolefins/

ADEKA "Flame retardant for polyolefins ADK STAB FP-2000 series" http://www.adeka-palmarole.com/newsroom/newsroom/507-flame-retardant-for-polyolefins-adk-stab-fp-2000-series.html

Ferric phosphate provides smoke suppression in epoxy

Ferric phosphate ($FePO_4$) at 0.5 – 3 wt% was tested as a synergist in PIN flame retarded epoxy resin (EP-44, MTHPA curing agent), in a 3 mm sheet. The PIN FR ammonium polyphosphate (APP) was used at 27-30 wt%. Addition of ferric phosphate somewhat reduced peak heat release rate, mass loss, total heat release, but in particular very greatly reduced smoke release rate, total smoke release and smoke factor. The ferric phosphate showed to considerably improve the char structure. The authors suggest that it acts by catalysing de-amination of APP. They conclude that ferric phosphate provides excellent smoke suppression in epoxy, offering important application opportunities.

"Influence of ferric phosphate on smoke suppression properties and combustion behavior of intumescent flame retardant epoxy composites", L. Liu et al. Iran Polm J, 2015 http://link.springer.com/article/10.1007/s13726-015-0327-2

Jet-set PIN fire safety

EMPA Switzerland has developed an innovative new PIN (Phosphorus, Inorganic, Nitrogen) fire safety treatment for wood furniture in business jets. The one-layer solution is based on a proprietary, high molecular weight, halogen-free flame retardant and is presented by EMPA as environmentally friendly and, because it does not evaporate, non toxic and odour free. Application and drying are rapid, minimising down-time for jets undergoing interior renovation, and enables stringent aircraft fire safety standards to be achieved wooden surfaces Project leader Sabyasachi Gaan at EMPA would like to explore the use of this FR technology other applications for household furniture and fittings in public buildings where fire safety standards are applicable, as well as in manufacturing of passenger aircraft. However, further research is needed to prove suitability of the new FR technology for such applications.

MPA project, Sabyasachi Gaan, see also pinfa Newsletters 37 and 43. "Environmentally friendly coating for aircraft furniture, Flame protection for the jet set », 9 January 2015 http://www.empa.ch/plugin/template/empa/3/154400

Growing non-halogenated flame retardant market expected

"HexaResearch" market report 2012-2020 predicts ongoing growth in non-halogenated flame retardants, driven by strict regulations to protect the environment and consumer banning halogenated products, combined with growing demand for engineering plastics particularly in automobiles and electronics. Public transport applications prefer non-halogenated flame retardant solutions because of low smoke density and low toxicity. The report expects non-halogenated flame retardants to become the dominant solution for respecting customer requirements and quality in engineering plastics.

"Transparency Market Report" projects a 8%/year growth for non-halogenated flame retardants through to 2018, driven by strict implementation of environmental regulations, fire safety requirements, and consumption of polymers in industries such as textiles, construction, electronics and transportation. Strict implementation of rules limiting production and import of goods containing halogenated flame retardants in North America and Europe will result in growth in non-halogenated flame retardant consumption in India, China, Indonesia and Malaysia which export towards these markets.

"Non Halogenated Flame Retardants Market Size, Market Share, Application Analysis, Regional Outlook, Growth, Trends, Competitive Scenario And Forecasts, 2012 to 2020", HexaResearch http://www.hexaresearch.com/research-report/non-halogenated-flame-retardants-market-analysis-segment-forecasts-2020/#src=whatech

"Non-Halogenated Flame Retardants (Aluminum Hydroxide, Phosphorus and Others) Market for Polymers (Polyolefin, Epoxy Resin, PVC, ETP, UPE, Rubber, Styrenics and Others) - Global Industry Analysis, Size, Share, Growth and Forecast, 2012 – 2018", Transparency Market Research http://www.transparencymarketresearch.com/non-halogenated-flame-retardants.html

California safer chemicals work plan

California's DTSC (California Department of Toxic Substances Control) has released a three-year work plan for safer consumer products regulation, part of California's "Green Chemistry Initiative". The plan covers Beauty/Personal Care and Hygiene, Building Products: Paints, Adhesives, Sealants and Flooring, Household/Office Furniture and Furnishings with perfluorochemicals or flame retardants, Cleaning Products, Clothing, Fishing and Angling Equipment, Office Machinery Consumable Products. Candidate chemical groups include brominated flame retardants (specifying as hazard traits: bioaccumulation, environmental persistence, undefined toxicity), some chlorinated FRs, and a few other flame retardant chemicals (see below). The objective, in particular for indoor furniture and furnishings, is to ensure that "older classes of chemicals e.g. brominated flame retardants" are not replaced by substitutes for which inadequate data is not yet available or which might pose toxicity concerns. To verify this, the work plan will look at organophosphorus flame retardants in building products and in furniture and furnishings.

Non-halogenated chemicals used as flame retardants listed by DTSC: t‑Butylphenyl diphenyl phosphate, Tricresyl phosphate, Trimethyl phosphate, Triphenyl phosphate, Trixylyl phosphate, 2‑Ethylhexyl diphenyl phosphate, Dimethylphosphate, Isodecyl diphenyl phosphate, Isopropylated triphenyl phosphate, Resorcinol bis(diphenyl phosphate

California Department of Toxic Substances Control (DTSC) , Safer Consumer Products (SCP) final 2015-2017 work plan http://www.dtsc.ca.gov/SCP/PPWP.cfm

FR Natural Rubber approved for London Underground

A new flame retardant, natural rubber developed by TARRC has been approved for use, after six months' successful testing by London Underground. The zero halogen, low smoke, low toxicity "Natural-FR" rubber compound, developed by TARRC (Tun Abdul Razak Research Centre, the Malaysian Rubber Board's UK Research and Promotion Centre) is used by Entrance Matting Systems (EMS) Ltd, UK and offers sustainability advantages including no halogens and further a life cycle analysis of the polymer has indicated a negative carbon footprint. The flooring application had to meet flammability requirements covering smoke density, smoke toxicity, heat release rate, flame spread, and dry and wet slip resistance. TARRC achieved this by modifying the natural rubber and using a flame retardant additive package. TARRC is also developing the product for technical applications such as railway vibration buffers, using a high-performance dynamic internal rubber with a flame retardant modified outer layer to ensure fire safety.

"TARRC develops flame-retardant NR for use in flooring", Rubber News 20th April 2015 http://www.rubbernews.com/article/20150420/NEWS/304209973

"TARRC commercialises Natural-FR" http://www.tarrc.co.uk/pages/NaturalFRLondonUnderground.htm

EMS Entrance Matting Systems "London Underground debris channel matting range" http://www.entrance-matting.com/content/london-underground

Natural magnesium minerals as PIN flame retardants

LKAB Minerals, an international minerals company, offers UltraCarb, a PIN flame retardant produced from natural magnesium minerals (hydromagnesite, a hydrated magnesium carbonate, and huntite, a magnesium calcium carbonate). The product range has recently been extended to include new, ultrafine and/or surface treated grades which optimise processing and performance. LKAB Minerals' PIN flame retardant products are used in a range of polymers, to contribute to fire safety, specifically for low smoke and char stabilization in a number of applications including cables, construction products, electrical and electronic equipment.

LKAB Minerals "Halogen-free FR filler for cables presented to US market"
http://www.lkabminerals.com/en/News/News/Halogen-free-FR-filler-for-cables-presented-to-US-market/

Low-cost, high-performance HFFR cable polymers

Teknor Apex, a leading US material science company, has launched two new series of Halguard® halogen-free, flame retardant compounds for jacketing of cables in public transport, construction, electrical and electronics applications. The Halguard 58600 Series HFFR offers performance at an economical cost. This series offers UL 94 V0 vertical flame rating (down to 1/16" or 1.6 mm) and can achieve UL 1685 FT4 or UL 1666 fire safety standards depending on overall cable design. Technical performance characteristics include excellent tensile strength, flexibility and operation at up to 105°C. The Halguard 58300 series HFFR offers exceptional flame retardance for critical applications such as data centres and electrical substations. This series offers LOI values of 53-56%, achievement of UL1685 FT4 vertical tray test and UL94 V-0 (down to 1/32" or 0.8 mm).

Teknor Apex cable compounds: see also pinfa Newsletters 37 and 39

Teknor Apex Halguard ® 58600 series: http://www.teknorapex.com/news/index.html?action=detail&id=369 and http://www2.teknorapex.com/l/26112/2014-09-11/mnq8k

Teknor Apex Halguard® 58300 series http://www2.teknorapex.com/e/26112/x-html-action-news-news-id-378/286856i/248873791 and datasheet http://www2.teknorapex.com/e/26112/l-26112-2014-08-18-cl8mr/286858i/248873791

NSF/ANSI 426 Environmental Leadership standard for servers

NSF International (previously National Sanitation Foundation) has published draft "Environmental leadership" standards for computer servers and components. The proposed standards specify a reduction of bromine and chlorine content in plastic parts > 25g: where such parts contain > 1 000 ppm bromine or chlorine (3 000 ppm for postconsumer recycled plastics), then an alternatives assessment must be carried out and justified. This is based on the chlorine and bromine thresholds specified in IEC 62474 Material declaration for products of and for the electrotechnical industry and would largely exclude the use of halogenated flame retardants in significant plastics parts, so inciting towards use of PIN fire safety solutions. NSF will vote on the proposal by ballot deadline 19th May 2015.

Draft New Standard - NSF/ANSI 426, issue 1, revision 1, Environmental Leadership Standards For Servers, published 17th April 2015, deadline for comments 19th May 2015 http://nsf.kavi.com/apps/group_public/download.php/27674/JC%20Memo%20and%20Ballot%20-%20426i1r1%20-%20New%20Standard.pdf

Denmark EPA suggests health risks from chlorinated FRs

An study by the Danish EPA (Danish Ministry of the Environment, Environmental Protection Agency) assesses the safety of chemicals present in children's car seats, strollers, mattresses and similar products (0-3 years age). Based on a literature screening, a number of chemicals considered to pose potential issues were measured in 59 samples from 30 items of baby equipment (chlorinated and brominated flame retardants, formaldehyde, phthalates, azo dyes). Migration tests were also carried out and then possible health and environmental risks assessed. Several chemicals were found at levels not conform to EU regulations (REACH). Three chlorinated FRs were the only chemicals for which the study indicates possible health risks (TDCP in child car seats and mattresses if used without covering sheets, TCEP and TCPP in baby slings). Non-halogenated PIN flame retardants would offer safer alternatives to ensure fire safety. None of the chemicals assessed were considered to pose environmental risks at the levels measured.

TDCP = Tris (1,3-dichloro-2- propyl) phosphate. TCPP = Tris (1-chloro-2-propyl) phosphate. TCEP = Tris (2-chloroethyl) phosphate (TCEP).

"Chemical substances in car safety seats and other textile products for children", survey of chemical substances in consumer products No. 135, 2015, ISBN 978-87-93352-07-0.

Banana tree sap flame retardant for textiles

Banana pseudostem sap (BPS), a regionally widely available by-product/waste of fruit production, was tested as an "eco-friendly" flame retardant for cotton textile (bleached woven cotton fibre). The cotton was pre-treated with tannic acid and alum, then impregnated in BPS by 30 mins. immersion under alkali condition, dosing soda ash (sodium carbonate) then drying at 110°C. Flame retardancy was significant, e.g. 1.6x increased LOI (limiting oxygen index), vertical self-extinguishing, horizontal afterglow spread 10x reduced compared to untreated textile. Wash durability of the BPS treatment was not good, but fibre mechanical strength was not deteriorated. The authors suggest that the flame retardancy effect of BPS may be due to the inorganic potassium, magnesium and phosphate salts in naturally contains.

"Flame resistant cellulosic substrate using banana pseudostem sap", S. Basak et al., Polish J Chemical Technology, 17, 1, 123-133, 2015 http://www.degruyter.com/view/j/pjct.2015.17.issue-1/pjct-2015-0018/pjct-2015-0018.xml

Synergy of PIN flame retardants in EVA

The combination of two nitrogen-inorganic PIN FRs (ATH aluminium trihydroxide and MB melamine borate) was tested in EVA (ethylene vinyl acetate). ATH was tested at 50 – 60 wt% and MB at 10 wt%. The PIN flame retardant EVA achieved UL94-V0. The combination of ATH and MB offered improved fire performance (loss cone calorimetry, limiting oxygen index) and decreased smoke opacity. The authors conclude that the combined PIN FR system improves the protective char formed on the polymer surface in case of fire and increases thermal conductivity (so delaying ignition), in addition to the fuel dilution and water-release cooling fire inhibition properties of ATH alone. Furthermore, the emission of the toxic smoke gas hydrogen cyanide in fire scenarios was reduced.

"The combination of aluminum trihydroxide (ATH) and melamine borate (MB) as fire retardant additives for elastomeric ethylene vinyl acetate (EVA)", C. Hoffendahl et al., Polymer Degradation and Stability 2015
http://www.sciencedirect.com/science/article/pii/S0141391015000658

Other News

Very low levels of phosphorus ester FRs were found in air over the Northern China Sea. Total concentration of nine P-ester FRs analysed (TCEP, TCPPs, TDCPP, TiBP, TnBP, TEHP, TPP, TPPO, TCPs) was 47 – 161 pico grammes/m^3 in airborne particles. None of the FRs were detectable in the gas phase. Chlorinated P- esters made up 66 – 84% of the FR content.

Environmental breakdown of flame retardants: an assessment of photochemical and microbial degradation concludes that more data is needed on breakdown on recent brominated flame retardants (introduced in place of banned or curtailed substances), including regarding degradation of polymer brominated FRs, identification of breakdown products, radical formation and transformation indoors.

New alternative brominated FRs were tested for teratogenicity and reproductive toxicity using zebrafish. At 10 µM concentration, PBP-AE (ATE = allyl 2.4.6-tribromophenyl ether) showed no effects, TBP-DBPE (DPTE = 2,3-dibromopropyl 2,4,6-tribromophenyl ether), DBE-DCBH (TBECH = 1,2-dibromo-4-(1,2-dibromoethyl)cyclohexane) and TBP-BAE (BATE = 2-bromoallyl 2,4,6-tribromophenylether) inhibited hatching and/or induced abnormalities in offspring.

TBOEP effects on Daphnia: the ethyl phosphorus FR TBOEP (tris(2-butoxyethyl) phosphate) was tested for chronic toxicity on D. magna (21 days) at 15 – 1500 µg/l. There were no significant effects on growth, survival or reproduction (compared to zero dosage control). Analysis showed that transcription was modified for a number of genes related to e.g. protein or energy metabolism.

"Occurrence and dry deposition of organophosphate esters in atmospheric particles over the northern South China Sea", Lai et al., Chemosphere 127 (195-200), 2015 http://www.sciencedirect.com/science/article/pii/S0045653515001174

"Scientists find link between flame retardants and obesity" http://medicalxpress.com/news/2015-03-scientists-link-flame-retardants-obesity.html

"Flame retardants found to cause metabolic, liver problems" http://medicalxpress.com/news/2015-02-flame-retardants-metabolic-liver-problems.html

"Photochemical and Microbial Transformation of Emerging Flame Retardants: Cause for Concern?", D. Chen et al., Environmental Toxicology and Chemistry, Vol. 34, No. 4, 687-699, April, 2015 http://onlinelibrary.wiley.com/doi/10.1002/etc.2858/abstract

"In silico and biological analysis of anti-androgen activity of the brominated flame retardants ATE, BATE and DPTE in zebrafish", A. Pradhan et al., Chemosphere in press 2015 www.sciencedirect.com/science/article/pii/S0009279715001222 *and "The brominated flame retardant TBECH activates the zebrafish (Danio rerio) androgen receptor, alters gene transcription and causes developmental disturbances", A. Pradhan et al., Aquatic Toxicology, vols. 142–143 (63-72), 2013* http://www.sciencedirect.com/science/article/pii/S0166445X13001938

"Chronic toxicity evaluation of the flame retardant tris (2-butoxyethyl) phosphate (TBOEP) using Daphnia magna transcriptomic response", M. Giraudo et al., Chemosphere 132 (159-165), 2015 http://www.sciencedirect.com/science/article/pii/S0045653515002386

Announcement: the full speaker and poster programme of FRPM 2015 is now online
European Meeting on Fire Retardancy and Protection of Materials, Berlin 21-25 June 2015
http://www.frpm2015.bam.de/en/programme/index.htm

Agenda

Events with active pinfa - pinfa-na participation are marked: ►

17 June	Brussels	pinfa General Assembly
16-18 June	Nicosia, Cyprus	2nd European Symposium of Fire Safety Science http://www.iafss.org/2nd-european-symposium-of-fire-safety-science/
22-25 June	Berlin, Germany	►FRPM 15th European Meeting on Fire Retardancy and Protection of Materials http://www.frpm2015.bam.de/en/home/index.htm **Announcement: the full programme (speakers & posters) for FRPM is now online** http://www.frpm2015.bam.de/en/programme/index.htm
30 June – 2 July	Shanghai	10th Shanghai International Flame-retarding Material Technology Fair http://www.chinaexhibition.com/Official_Site/11-7030-CFRS_2015_-_The_10th_Shanghai_International_Flame-retarding_Material_Technology_Fair.html
19-22 July	Beijing	10th Asia-pacific Conference on Combustion http://www.cce.tsinghua.edu.cn/aspacc2015
28-30 Sept	Cambridge, UK	6th International Symposium Human Behaviour in Fire http://www.intersciencecomms.co.uk/html/conferences/hb/hb15/hb15.htm
5-7 Oct	New Delhi	Fire India http://www.fire-india.com/
5-7 Oct	Tsukuba, Japan	10th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) http://www.iafss.org/10th-aosfst/
3 Nov	Brussels	**pinfa workshop Building the future for flame retardants in B&C (building and construction)** www.pinfa.eu
4 Nov	Brussels	pinfa General Assembly

***Publisher information**: This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.*
***Abbreviations**: See pinfa website: http://www.pinfa.eu/library/glossary-of-abbreviations.html*

Tuesday 3rd November 2015 – Brussels

pinfa stakeholder & industry workshop:
Building the future for flame retardants in B&C (building and construction)

Information: pinfa secretariat and www.pinfa.eu

Developments in fire safety and PIN flame retardant solutions
Regulators
Insurers
Architects and construction industry
PIN flame retardant producers and users – compounders – construction and insulation products
Scientists – experts - NGOs
Fire standards – Construction Products (CPL / CPR) – harmonisation
Smoke emissions, toxicity and corrosivity
Green buildings and ecolabels – indoor air quality

pinfa

Newsletter for non-halogen fire safety solutions

June 2015 – N° 53

"Do Flame Retardants Work?"

A 4 ½ minute video asks the question "Do flame retardants work?" to 6 leading experts and scientists, interviewed at the BCC Research annual conference. They replied:

- **Douglas Fox, American University**: decades of university and government research has confirmed that FRs delay time to flashover – from just 3 minutes without FRs - which is a matter of life and death.
- **Jaime Grunlan, Texas A&M University**: many tests in his University's labs confirm that products with FRs don't burn, whereas without FRs they burn vigorously, with billowing black smoke. There is no question that FRs work.
- **Marcello Hirschler, GBH International**: when used right, FRs very significantly increase escape and rescue time and massively decrease heat release, which can kill in fire. Two recent studies confirm this.
- **Bob Howell, Central Michigan University**: examples of fires in aircraft and school bus, where all passengers got out alive and uninjured, show the FRs allow time to escape. They both delay ignition and retard flame spread.
- **Charles Wilkie, Marquette University**: we use more and more plastics which are inherently flammable, burning with lots of smoke. FRs can prevent these fires and save lives.
- **Frederico Cioso, Wallengerg Wood Science Center**: without FRs, buildings would not be protected from fire and if one occurs, many lives would be lost.

"Do Flame Retardants Work", 4 ½ mins video, interviews from the BCC Research annual conference on Recent Advances in Flame Retardancy of Polymeric Materials, sponsored by the American Chemistry Council http://polymer-fire.com/2015/05/26/do-flame-retardants-work/

Micronized polyols for PIN intumescent fire safety

Perstorp has extended its Charmor™ range of micronized polyols for intumescent coatings for fire safety treatment of steel building structures, offering light weight and aesthetic quality. Charmor is available for both water-based and solvent-based coatings and with two particle sizes (15 or 40 microns). The new Charmor Care uses raw materials partly derived from renewable sources. Charmor provides a reliable, high consistency, performance carbon source to combine with other PIN components of intumescent systems to form, in case of fire, an insulating carbon foam or char several centimetres thick.

"Charmor™ micronized polyols from Perstorp respond to increasing calls for high quality intumescent coatings for steel structures", 22 April 2015
http://www.pressreleasefinder.com/pr/PERSPR037/en

EU project develops innovative PIN FR wood composites

The EU-funded "Limowood" project has developed novel PIN flame retardant wood-plastic composites (WPC) offering innovative technical and moisture-resistance performance, enabling production by press technology of furniture and use in kitchens and bathrooms. The composites are made of approximately 50% wood and 50% thermoplastic (generally polypropylene). Recycled wood and recycled thermoplastic can be used. Fire safety is achieved using PIN flame retardant combinations (phosphorus and nitrogen based), achieving UL-94 V0. LOI (limiting oxygen index) is 1,5 times higher than for untreated WPC and the Limowood product resists 3 minutes contact with a Bunsen burner without ignition. The Limowood material does not contain formaldehyde and offers quality aesthetic appearance and mechanical characteristics enabling glue or screw assembly of furniture. Its exceptional moisture resistance means that, unlike most wood products, it can be used in kitchen or bathroom fittings.

The Limowood project is led by Inspiralia (Spain), ITA (Spain) and Fraunhofer Institute for Wood Research WKI (Germany), in cooperation with industrial partners Javal S.L (Spain). Beologic n.v (Belgium), Holzwerk Baur Gmbh (Germany) and Societé Andre Bondet (France).

"Bringing wood to the bathroom", Ecocomposites, 11th May 2015
http://www.ecocomposites.net/index.php?option=com_content&view=article&id=10728%3Abringing-wood-to-the-bathroom

Limowood web site: www.limowoodcomposites.com

Children's dressing-up clothes fire dangers

Sainsbury's (UK supermarket and 7th biggest clothes retailer) has announced that as of Halloween 2015 all children's dressing-up outfits will be tested to the British nightwear flammability standard, a demanding clothes fire safety performance already available. Furthermore, in 2016 the company will introduce its own even more rigorous standards. This follows the interview of TV star Strictly Come Dancing presenter Claudia Winkleman on BBC's Watchdog programme, after her daughter suffered serious burns when her Halloween witch costume brushed against a candle. Tesco, Asda, Marks and Spencer, Waitrose, John Lewis, Aldi, BHS, Morrisons and Mothercare are cited by the UK Chief Fire Officers' Association as also planning such action.

The BBC, with Bedford Fire Service, tested the flammability of three supermarket purchased costumes, putting them in contact with a small tea-light. One burned slowly, but "*enough to do significant damage to child's skin*". The other two (made of polyester and polyester+polypropylene) burned fast and violently, one with flames to the torso after just two minutes, the other engulfed in flames after only 20 seconds. The fire service: "*Terrifying, should not be on sale*".

Yet, as the BBC underline, these costumes are legally on sale with a CE safety mark, because they have passed EN71 test, the fire safety requirement for "toys". For the BBC, this test is not safe for clothes. Interviewed expert on textile flammability, Richard Horrocks, Bolton University, underlines that a suitable test exists, the British nightwear flammability standard (BS5722, Test 3), which is "*proven to have reduced both fatal and non-fatal casualties*". Sainsbury's refers to this expert statement and suggests that the British nightwear flammability standard should be applied across the EU under toy safety regulation.

Sainsbury's Non-Food Director stated "*The safety of children is our number one priority and introducing more rigorous safety standards for our children's dress-up is the right thing to do*."

UK CFOA (Chief Fire Officers' Association) "Press Release - CFOA welcomes Sainsbury's announcement on children's fancy dress costumes", May 2015 http://www.cfoa.org.uk/19812

Sainsbury's: "Sainsbury's to introduce enhanced safety standard for Children's Dress-Up" http://www.j-sainsbury.co.uk/media/latest-stories/2015/0522-sainsburys-to-introduce-enhanced-safety-standard-for-childrens-dress-up/

BBC Watchdog, May 2015 (series 35, episode 8) http://www.bbc.com/news/entertainment-arts-32723504

PIN-FR plastic profiles

Keller Products, USA, offers a range of PIN fire safety solutions for extruded plastic profile elements, for use in buildings, furniture, installations, etc. Non-halogenated flame retardants are used in synergy with smoke suppressant technology to provide an increase in resistance to ignition, reduce the burn rate, reduce the spread of smoke emissions and flames, while minimising plastic dripping during combustion. The company has developed PIN flame retardant packages enabling ABS and PC/ABS coextruded profiles to achieve the UL94V-0 fire resistance requirement and a TPO (thermo plastic olefin elastomer) meeting ASTM E84. The company is also developing "green" products produced from recycled or bio-sourced plastics.

More: http://www.kellerplastics.com

Aerospace industry launches chemical reporting

IAEG (International Aerospace Environmental Group), which groups global aerospace companies (including Airbus, Boeing, Bombardier, Rolls-Royce, Dassault …) has launched an Aerospace and Defence Declarable Substances List (AD-DSL). The objective is to respond to environmental scrutiny and facilitate work with regulatory and the supply chain. A list of nearly 800 chemicals has been published, classified in three groups (prohibited/identified for prohibition, disclosure required by regulation, likely to be subject to requirements in the future). BDEs including Deca, SCCPs and HBCD are in the first group, antimony compounds are in the third group, the only PIN FRs cited are Tris(aziridinyl)phosphinoxide (group 3) and Trixylyl phosphate (group 2), both of which are now restricted under REACH.

IAEG Aerospace and Defence Declarable Substances List http://www.iaeg.com/workgroups/wg1/addsl/
Press release "IAEG Publishes First Aerospace & Defence Declarable Substances List" 7th May 2015
http://www.iaeg.com/elements/pdf/iaeg_nrl_ad-dsl_5_2015.pdf

Fire risk building façade materials - Australia

A major fire in Melbourne, Australia, has been linked to non-compliant aluminium/foam cladding materials. The fire rapidly spread from the 6th right up to the 21st floor of the 23 storey building. There were no casualties, but material damage is estimated at over 5 million Aus$. The MFB (Melbourne Fire Brigade) report on the fire 25/11/2014 indicates that it started with a cigarette which ignited a plastic container, then a wooden table and an air conditioning unit on a balcony. The fire was spread by the aluminium/foil cladding material of the 2010 building which MFB indicates did not conform to building regulation "combustibility" obligations. The builders however claim that the cladding was in conformance to Australian standards for ignitibility, flame spread, heat and smoke, because at the time no product passed the "combustibility" test. Over 100 apartment owners are engaging a class action against the builders, who will face not only the fire repairs and consequential costs but also the replacement of the whole building cladding.

MFB Lacrosse Docklands Report fire post incident analysis summary (PIA) http://www.mfb.vic.gov.au/Community-Safety/Campaigns-and-Events/Lacrosse-Docklands.html

"Docklands apartment tower fire fuelled by material in building's walls, says MFB
http://www.theage.com.au/action/printArticle?id=98843973

Fire risk building façade materials – Azerbaijan

15 people died and over 60 were injured in a fire in a 16-storey residential building in Baku, Azerbaijan, 19th May 2015, most because of toxic smoke. The building façade was made of polyurethane cladding panels, allegedly installed by "Global Panels", from a factory inaugurated by the Azerbaijan President. The company's director was arrested the day after the fire, accused of installing non-conforming panels. A non-fatal fire already occurred in polyurethane sidings in Baku on April 10th, following which authorities issues a statement that the Global Panels material had been tested and showed no safety concerns.

"Polyurethane façade" fire video YouTube https://www.youtube.com/watch?v=GnKiukWEI0A

BBC News http://www.bbc.com/news/world-europe-32809520

Development of fire risk in cities

A study from Berlin and Moscow suggests that the number of fires has increased over the last century and that fire deaths have increased, with nearly all the casualties occurring in residential fires. New fire causes such as electricity, negligence dealing with open flames, smoking and arson are important. Major fires are considered to have become “more violent” than in the past. This situation, despite efforts in building safety and fire protection, are compared to the considerable changes in materials and contents in buildings, with new fire hazards in building materials, and considerable presence of plastics, electrical equipment, etc. in residential buildings. Considerable data gaps are underlined.

“Fire risks in German cities from 1900 to 2009” in German (Brandrisiken deuscher Städdte im Zeitraum 1900 bis 2009), J. Herweg, P. Wagner, S. Sokolov, Y. Kolomiets, Berlin Fire Service and Moscow State Academy for Fire Safety. VFDB magazine 2/2015, 16 pages www.vfdb.de

Performance PIN FR polyamides for railways and E&E

Nilit Plastics, a world leader in polyamides, has launched a new range of high performance PIN flame retardant compounds. The non-halogenated FRIANYL® A3 and B3 range are certified to the new European railway specification EN 45545, class H3 – the highest safety level and are V0 or V2. The formulation ensures low smoke density in case of fire. The non-halogenated FRIANYL® XT grades are UL 94 V-0 at 0.75mm, are self-extinguishing. They can respect operating temperatures up to 130°C or 140°C, offer high stiffness and strength. The new PIN compounds are available with glass fibre reinforcement or unfilled and are adapted for electrical and electronic applications, such as isolators, transformers, circuit breakers and contactors.

High performance flame retardant compounds - Meeting new European railway fire protection regulations – Nilit Plastics http://www.nilit.com/plastics/pr-00020.asp

Development of low-smoke PIN applications in polypropylene

May 2015: GrandView Research market study suggests that low smoke PIN flame retardant polypropylene (PP) applications will nearly double by 2020, reaching US$ 664 billion by 2020. Demand increase is expected in construction, automotive, electrical and electronics, driven by demand for polypropylene in these applications, with increasing substitution of metals and wood, and by “*growing awareness regarding the halogenated toxicity and fire safety issues*” and “*negative environmental effects*” supported by regulatory pressure and low-smoke requirements. Challenges for PIN flame retardants in PP identified as cost, colour impairment, high loading levels, offer market opportunities for innovations towards improved PIN FRs, technology standardisation and product availability.

GrandView Research “Low Smoke Halogen Free Flame Retardant Polypropylene (PP) Market Analysis By Application (Construction, Automotive, Electrical & Electronics, Industrial), And Segment Forecasts To 2020”, ISBN Code: 978-1-68038-402-4, May 2015 http://www.grandviewresearch.com/industry-analysis/low-smoke-halogen-free-flame-retardant-polypropylene-pp-market

ABNewsWire, 11/5/2015: http://www.abnewswire.com/pressreleases/low-smoke-halogen-free-flame-retardant-polypropylene-pp-market-by-application-is-expected-to-reach-6640-million-by-2020-grand-view-research-inc_27987.html

Other News

NSF Environmental Leadership standard for computer servers: NSF has put to ballot a proposed update of Standard NSF 426 for servers. Deadline for comment was extended to 22 May. The proposal excludes chlorine and bromine at more than 1000 ppm in plastic parts > 25g, or an alternatives assessment is required. http://standards.nsf.org/apps/group_public/document.php?document_id=27674

Limits for POP brominated FRs in recycled products agreed: 11th May, Geneva, a UN meeting on persistent organic pollutants (POPs) and hazardous wastes agreed limits of 1000 mg/kg for the brominated flame retardants HBCD, PentaBDE and OctaBDE (classed as POPs) in recycled products, higher than for many POPs which are limited to 50 mg/kg. The objective is to facilitate recycling. *Chemical Watch "Three substances banned under POPs convention: Difficult negotiations lead to series of fixes" 18/5/15 https://chemicalwatch.com/23844/three-substances-banned-under-pops-convention*

"Bio inspired" flame retardants: NIST (USA) has published videos showing testing on upholstered furniture of a number of "bio inspired" PIN flame retardants, based on materials such as seaweed gel (agar), potato starch, clay used as coatings. The best product tested (starch plus a boron product used in body deodorants) did not prevent foam from burning, but reduced peak heat release significantly (63%) and resulted in self-extinguishing after 9 minutes. *http://phys.org/news/2015-04-bio-flame-retardants.html*

Petition to US CPSC: a petition from scientists, consumer associations and fire fighters is asking the US Consumer Product Safety Commission to ban any organohalogen flame retardant use in four categories of consumer products: children's products, furniture, mattresses and the casings around electronics.
Press release http://earthjustice.org/news/press/2015/health-firefighter-consumer-and-science-groups-seek-ban-on-household-products-with-toxic-chemical-flame and petition http://earthjustice.org/sites/default/files/files/Petition%20to%20Consumer%20Product%20Safety%20Commission_3.31.15.pdf

Tuesday 3rd November 2015 – Brussels

pinfa stakeholder & industry workshop:
Building the future for flame retardants in B&C (building and construction)

Information: pinfa secretariat and www.pinfa.eu

Developments in fire safety and PIN flame retardant solutions
Regulators
Insurers
Architects and construction industry
PIN flame retardant producers and users – compounders – construction and insulation products
Scientists – experts - NGOs
Fire standards – Construction Products (CPL / CPR) – harmonisation
Smoke emissions, toxicity and corrosivity
Green buildings and ecolabels – indoor air quality

***Publisher information**: This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.*
***Abbreviations**: See pinfa website: http://pinfa.org/index.php/15-glossary-of-abbreviations*

Agenda

Events with active pinfa - pinfa-na participation are marked: ►

22-25 June	Berlin, Germany	►FRPM 15th European Meeting on Fire Retardancy and Protection of Materials http://www.frpm2015.bam.de/en/home/index.htm
30 June – 2 July	Shanghai	10th Shanghai International Flame-retarding Material Technology Fair http://www.chinaexhibition.com/Official_Site/11-7030-CFRS_2015_-_The_10th_Shanghai_International_Flame-retarding_Material_Technology_Fair.html
1 July	Munich	Brandschutz-Tagung http://www.sicherheitsexpo.de/brandschutz/tagung-1-2-juli-2015.html
19-22 July	Beijing	10th Asia-pacific Conference on Combustion http://www.cce.tsinghua.edu.cn/aspacc2015
15-16 Sept	Braunshweig, Germany	Braunschweiger Brandschutz-Tage http://www.brandschutztage.info/
28-30 Sept	Cambridge, UK	6th International Symposium Human Behaviour in Fire http://www.intersciencecomms.co.uk/html/conferences/hb/hb15/hb15.htm
5-7 Oct	New Delhi	Fire India http://www.fire-india.com/
5-7 Oct	Tsukuba, Japan	10th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) http://www.iafss.org/10th-aosfst/
14-16 Oct	Izmir, Turkey	COST MP1105 Workshop on "Flame Retardancy Applications and Related Regulations for Protective Textiles" COST.MP1105@UGent.be and International Technical Textiles Congress (6th ITTC) www.ittc2015.com
3 Nov	Brussels	**►pinfa workshop Building the future for flame retardants in B&C (building and construction)** www.pinfa.eu
4 Nov	Brussels	►pinfa General Assembly
8-10 Dec	Cologne, Germany	Fire Resistance in Plastics 2015 (AMI) http://www.amiplastics.com/events/event?Code=C673
	2016	
1-2 March 2016	Cologne, Germany	Sustainable Plastics 2016, from sourcing to end of life recovery (AMI) https://www.amiplastics.com/events/event?Code=C706
8-10 June 2016	Princeton, USA	SiF'16 Structures in Fire http://www.structuresinfire.com/corpo/conferences.html
13-16 June 2016	Las Vegas	NFPA Conference & Expo http://www.nfpa.org/training/events-calendar
4-6 July 2016	London	Interflam 2016 (14th International Conference and Exhibition on Fire Science and Engineering) www.intersciencecomms.co.uk
29-30 Sept 2016	London	ICFSST 2016 : 18th International Conference on Fire Safety Science and Technology https://www.waset.org/conference/2016/09/london/ICFSST/call-for-papers

pinfa

August 2015 – N° 54

Newsletter for non-halogen fire safety solutions

pinfa launches renewed website

pinfa has relaunched its website www.pinfa.eu to both improve performance on mobile devices, ensure a clearer and more user-friendly layout, and update content. The website aims to provide a comprehensive access point for information on fire safety and PIN flame retardants for both the general public and for industrial users of flame retardants, such as compounders and Original Equipment Manufacturers (OEMs). A new section addresses "Sustainability" (environment, regulatory, recycling) and the "Fire Safety" section is enhanced. The website aims to contribute to pinfa's commitment to collaboration: "*pinfa works in partnership with stakeholders (NGOs, environmental, consumer associations, scientists, regulators, fire safety experts, user industries…) to ensure safe use of flame retardant products*". We intend to continue to improve the site, so please do let us know if you find any technical problems or content questions with the website. www.pinfa.eu

Do flame retardants improve fire safety?

A series of three papers by fire safety specialist M. Hirschler assess to what extent flame retardants, when correctly used, reduce heat release rate from polymers (such as plastics and textiles) and how important this is for fire safety. This includes a summary and assessment of available fire test data, analysis of why heat release rate is the key factor often defining whether a fire will lead to casualties and major damage and specific information concerning flame retardants' impact on fire safety for 15 widely-used man-made and natural materials.

Overall, in (1), the author concludes that "the correct use of flame retardants (by using efficient systems, designed for the substrate, at sufficient levels) will decrease heat release rate and thus have a very positive effect on fire safety".

Why heat release rate is critical?

Heat release rate (HRR) is frequently measured in material fire performance tests or specified in fire safety standards. Many assessed studies demonstrate that the widespread use of this parameter is justified, in particular this was highlighted in Babrauskas & Peacock 1992. This study shows that halving HRR of a burning chair considerably increases the time before conditions in a small room become lethal, from c. 3 to c. 10 minutes. On the other hand, making smoke emissions less toxic or making the chair less easily ignitable has virtually no effect. HRR is critical because it defines the magnitude of the fire and also, whether or not, and how rapidly, the first burning item will spread fire to other items.

Flame retardants can also, in many cases, prevent fires starting (reduce material ignitability) and impact smoke toxicity, but reducing heat release is the most critical factor for saving lives and preventing major fire damage. In particular, heat release rate is critical to "flashover", when accumulation of heat and fire gases causes a whole room to ignite. Flashover is the key point at which fires undergo a massive and irreversible scale-change in hazard and impact, smoke emission and smoke toxicity. Once flashover has occurred, life in the room is no longer viable. *NB: for an explanation of flashover and escape times, see* *http://pinfa.org/index.php/flame-retardants/fire-safety*

Smoke dangers

Studies presented, using both animals and human volunteers, show that both were able to escape even after exposure to massive concentrations of irritants, showing that irritants rarely cause incapacitation (they do not prevent escape). This, together with data demonstrating that human lethality is directly correlated to carbon monoxide (CO) levels in blood, confirms that the essential hazard in fire gases is carbon monoxide, emissions of which depend on the amount of material burning and on access to air during burning (which is reduced with increasing amounts of material burning). Carbon monoxide emissions are largely unrelated to the type of polymer material burning. This confirms the essential importance of heat release rate in fire hazard.

It should be noted, that the above addresses acute fire hazard (danger or lethality in the fire) and not possible long-term toxic effects of smoke exposure.

Relevance of fire tests

Assessment of 36 studies on materials fire testing as prescribed by heat release fire standards (e.g. calorimeter tests), concludes that these tests do give a good indication of heat release in real fire conditions, and are therefore a realistic and effective way of defining materials fire hazards or prescribing materials fire safety properties.

Also, 1988 NBS/NIST room scale fire tests of flame retarded and non-flame retarded items are reassessed. These studies have been recently questioned, but the author concludes that the conclusions of the NIST report are valid and fully relevant to the question of whether the use of flame retardants reduces fire dangers as used in household products: the study used "commonly used plastic products" with "commercial formulations" of flame retardants in the "most commonly used FR/polymer combinations" (of the time).

The items were tested both individually and in combination in a fully furnished room, comparing flame retarded with non flame retarded items: TV sets, computer housings, circuit boards, upholstered chairs and electric cables.

Key results were that the amount of material consumed in the full scale room fire with non flame retarded products was more than twice that in the room with flame retarded products, the heat release was four times

higher and the carbon monoxide equivalent gas toxicity was two times higher. The study authors concluded that there was no evidence that the commercial use of flame retardants in these products had any negative effect on any aspect of fire hazard, including smoke. The most important result was that the estimated time to escape from the room with flame retarded items was fifteen times higher than in that from the room with non flame retarded items.

Importance of adequate fire safety standards, e.g. automobiles

The author underlines that flame retardants are only useful if used appropriately, and this depends on having adequate fire safety standards. A cited study of car seat padding foams shows that use of low levels of flame retardants to meet the (widely criticised and undemanding) FMSVSS 302 fire standard (automobiles) has no significant impact in reducing heat release, and so on real fire hazard.

Also, appropriate flame retardant use in combined materials in complete items is also essential. Other cited studies show that the use of flame retardants to meet the (now repealed) CA TB 117 in foams does not significantly reduce heat release, but when combined with a flame retarded covering textile (here, one meeting the NFPA 701 test) heat release reduction is very significant and the item extinguishes when the flame is removed.

Flame retardants and fire hazards of different materials

In (2), the author assesses the effectiveness of flame retardants in reducing fire hazard in 15 different materials, relevant because of their inherent fire hazard and their widespread use in consumer products, construction, etc: ABS / styrenics / HIPS, cellulose or cotton fabrics, engineering thermoplastics (including PC), epoxy resins, EVA / polyolefins, flexible PVC, LDPE (polyethylene), nylon / polyamides, polyesters / PET, polycarbonate, polypropylene, polystyrene, polyurethanes (foam and thermoplastic), rigid PVC, woods.

Data from over 100 studies for these different materials are summarised, showing to what extent appropriate flame retardant use has been demonstrated to reduce HRR (heat release rate).

The different flame retardant systems tested for each material and the HRR reduction achieved are detailed.

The author concludes that although studies available are variable in date and quality, "*the breadth of the work covered and the similarity of the interpretation that can be obtained from the studies indicate that the conclusions that can be drawn are fully appropriate. In summary, this work demonstrates that flame retardants, when added as appropriately researched with the correct systems and in the proper amounts, will decrease the heat release rate for virtually all polymeric materials. Thus, the correct use of flame retardants will decrease heat release rate and lower fire hazard and, thus, have a very positive effect on fire safety*".

Importance of appropriate flame retardant use and of fire standards

In (3), the author assesses qualitatively the above cited data for the 15 different materials. Results for 15 different polymer systems, covering these materials, show that flame retardants reduce heat release rate (HRR) by 30 – 80%. This variability confirms that simply stating that a material is "flame retarded" does not mean that adequate fire safety improvement is achieved. "Flame retarded" can simply mean that some level of flame retardant has been added to the product, and in some cases this may not be appropriate or adequate. Also, some materials continue to show very high heat release rate, and so fire hazard, even with flame retardants. Therefore (as indicated above) even some fire performance standards are so inadequate that achieving them does not imply significantly improved fire safety.

The author underlines that flame retardant performances are polymer specific: flame retardant combinations effective in one material can be largely useless in another. However, appropriate flame retardant use (adequate and adapted) can reduce heat release rates by an order of magnitude, so considerably reducing the hazard of fires.

(1) "Flame retardants and heat release: review of traditional studies on products and on groups of polymers", M. Hirschler, Fire & Materials, 39(3), 207-231, April 2015 http://onlinelibrary.wiley.com/doi/10.1002/fam.2243/abstract

(2) "Flame retardants and heat release: review of data on individual polymers", M. Hirschler, Fire & Materials, 39(3), 232–258, April 2015 http://onlinelibrary.wiley.com/doi/10.1002/fam.2242/abstract

(3) "Fire safety and flame retardants", M. Hirschler, 24th BCC Conference on Recent Advances in Flame Retardancy of Polymeric Materials, May 2013, Stamford, CT, 2013 www.bccresearch.com

NOTE: M. Hirschler received financial support from the North American Flame Retardant Alliance of the American Chemical Council for the first two papers.

Presentation "Effect of flame retardants on polymer heat release rate", M. Hirschler, Fire & Materials 2015 http://www.intersciencecomms.co.uk/html/conferences/fm/fm15/fm15prog.htm

See also "Heat release rate: the single most important variable in fire hazard", V. Babrauskas V, R. Peacock, Fire Safety Journal, 18:255–272, 1992.

Killing fumes: call for EU action on fire smoke toxicity

A meeting hosted in the European Parliament heard that toxic smoke causes around 2/3 of fatalities in home fires and that fumes are becoming more toxic. Speakers called for EU regulation to reduce building materials and consumer products smoke production. The meeting was organised by Fire Safety First www.firesafetyfirst.eu and hosted by MEP's Pavel Poc and Christel Schaldemose, June 30th 2015. Richard Hull, University of Lancashire, UK, showed that smoke casualties are decreasing more slowly in the UK than other fire deaths, despite national efforts on product fire safety and smoke alarm systems, showing that smoke toxicity danger is increasing. Marc Sabbe, Leuven Emergency Medicine Clinic, Belgium, explained that smoke can kill by heat (lung burn), short term toxic gases which can immobilise (preventing escape) or kill, or by long-term toxicity. Tommy Kjaer, Danish firefighter and Chair of the European Fire Fighters' Union, called for regulations to limit smoke production and toxicity. Gwenole Cozigou, DG GROW European Commission, emphasised the difficulty of regulating smoke emissions from building materials, given the need to take into account how and where they are installed.

"Fire fighters and fire experts call the EU to action on toxic fire smoke", International Fire Protection Magazine, 6/7/2015 http://ifpmag.mdmpublishing.com/stop-fatal-fire-fumes/

Initiative primarily funded by Fire Safe Europe http://www.firesafeeurope.eu/

Call for information on health effects of foam flame retardants

NIOSH (US National Institute for Occupational Health and Safety) is calling for information on health effects of occupational exposure to flame retardants in polyurethane foam. Companies using FR foams, in particular spray application for building insulation, are asked to provide information, or to volunteer for collection of on-site air samples during foam application and at intervals afterwards. The objective is to define the appropriate levels of worker PPE (personal protective equipment), of ventilation and of cordoning time for spray areas after application. NIOSH already has information on the principal compound used in foams (MDI and isocyanates) but wishes to extend information on amines, glycols and flame retardants, including phosphates.

Polyurethane foam user companies willing to cooperate in data collection with NIOSH are asked to contact Cherie Estill, NIOSH CLF4@cdc.gov + 1 (513) 841-4476

Further information http://blogs.cdc.gov/niosh-science-blog/2012/03/21/sprayfoam/

Huber to develop Safire® PIN FR technology

Huber Engineered Materials (HEM) has acquired the patented Safire® phosphorus and nitrogen based PIN flame retardant technology from Floridienne Group and Catena Additives (100% subsidiary of Floridienne Group). The Safire® PIN FR range combines nitrogen with metals and phosphorus (e.g., melamine poly-metal phosphate, based on aluminium, zinc, magnesium for applications in various plastics; e.g., polyamines, PBT) to offer mechanical, electrical and fire safety performance. A key advantage is the reduced smoke opacity in case of fire, with also low smoke toxicity, both of which are important for enabling escape from fire. The Safire® range adds to Huber's current PIN fire safety technologies, including its wide range of alumina trihydrate (ATH), magnesium hydroxide (MDH) and molybdate halogen-free flame retardants and smoke suppressants. The Safire® PIN flame retardants open up new market segment opportunities for HEM as their use can be applied to engineering thermoplastics, thermosets, coatings, nylon, PBT, PU and epoxies for applications such as electrical/electronic components and housings or intumescent paints. Huber's objective "*is to develop a full complement of halogen-free products that meet the most demanding fire retardant requirements our customers are facing*."

Huber is a member of pinfa-na (pinfa North America). http://www.hubermaterials.com/news/2015/huber-strengthens-halogen-free-fire-retardant-portfolio-with-safire-technology-acquisition.aspx

Call for home fire safety regulations

In a media interview, Miquel Rajat, Catalunya Fire Department Inspector responsible for coordinating casualties investigations, has called to extend fire safety regulations applying to contents (consumer goods, furnishings). He also called for improved collection of information from fire brigades about fire incidents and establishment of indicators of plastics consumption per population. The interview was an initiative of the Spanish professional association for fire safety techniques (APBT) and the Spanish association of fire protection organisations (Tecnifuego-Aespi), within the pinfa Outreach project.

Revista prevencion de Incendios, n°63, Q3/2014, p 34-35 « Productos ignifugantes libres de halogenos » *http://issuu.com/riesgolaboral/docs/revista_prevenci__n_de_incendios_n__d2c27cd53fd8f6*

English translation at http://pinfa.org/index.php/media-events/news/212-fire-prevention-magazine-spain-10-2014

Best practice guide for LSZH cables

ITRI Labs UK have published a 5-page "Best Practices" guide for LSZH (Low Smoke Zero Halogen) wire and cables. The guide summarises the development of zero or low halogen cables, the relation to low smoke, and the properties of these new cable products. Information includes: commonly used abbreviations, industry standards defining low smoke and defining low and zero halogen for wires and cables, non halogenated flame retardation methods, relevant fire testing, thermoset and thermoplastic polymers used, applications and performance aspects (flexibility, temperature tolerance, friction coefficient), sustainability. The guide underlines that LSZH cables widely vary, depending on the polymer used, flame retardant solution and performance additives, so that careful selection for specific applications is important. The guide also emphasises the parameters which can make the use of low smoke cables important, including the relative mass of cables compared to other combustible materials, sensitivity of installations and the possible impact of smoke density on escape.

ITRI Labs UK "Low Smoke Zero Halogen wire and cable best practice" http://www.itrilabs.co.uk/landing-pages/low-smoke-zero-halogen-wire-cable-best-practice-guide/

PIN fire-safe electrical conductive plastic

Premix offers PIN flame retardant electrically conductive polymers for specialist applications, including in ESD (electrostatic discharge) or ATEX (explosive atmospheres). PRE-ELEC® TP 14815 offers very low smoke density, self-extinguishing and UL94 V-0 fire performance and excellent mechanical and processing properties for injection molding and extrusion (processing up to 300°C without risk of corrosion). Fire safety is based on the mineral PIN FR magnesium dihydroxide (MDH), which has no health or environmental risks. The polymer can be combined with many polypropylene or polyethylene polymers, for example to provide a conductive coating on plastic pipes or fittings in ATEX applications. Premix is the leading global specialist in electrically conductive plastics and other specialist applications, based in Finland, since 1983.

Premix http://www.premixgroup.com/fire-retardant-for-better-safety-and-health/ and http://www.premixgroup.com/product-cats/conductive-plastics/

Fire fighters and flame retardant activism

A study based on 125 interviews with fire fighters and stakeholders in the USA assesses the reasons for, consequences and orientations of fire fighter participation in actions to restrict the use of certain flame retardants and in pressing for reforming fire safety standards to reflect best available fire science. The paper underlines that further environmental and occupational health scientific investigation is needed to better understand the exposure of firefighters to fire pollutants and disease pathways, including biomonitoring of fire fighters blood. Fire fighters are also cited as noting the considerable environmental impacts of fires, both through smoke and toxic emissions in the fire and through replacement of the destroyed goods. The authors conclude that fire fighter pressure to improve health safety of flame retardants is likely to continue, as well as pressure from other professions particularly exposed to flame retardants in work spaces, such as hospitals, aircraft, buses.

"Firefighters and flame retardant activism", A. Cordner et al., New Solutions, Vol. 24(4) 511-534, 2015 http://dx.doi.org/10.2190/NS.24.4.f

"Halogenated Flame Retardants: Do the Fire Safety Benefits Justify the Risks?", S. Shaw et al., Reviews on Environmental Health 25(4) (2010): 261-305, http://dx.doi.org/10.1515/reveh.2010.25.4.261

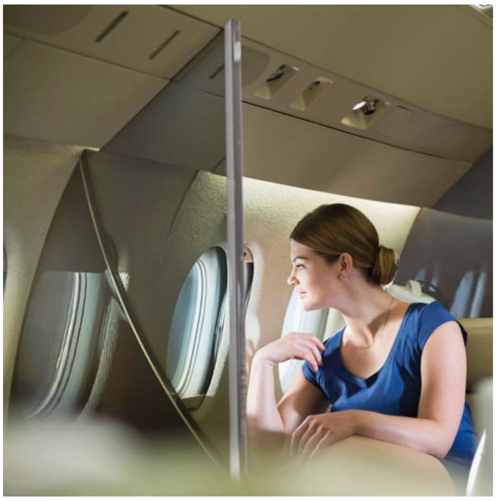
Electrical enclosures for demanding marine environments

Pacific Fishermen shipyard and PFI Marine Electric, Seattle, use PIN flame retardant electrical enclosures from Michigan-based Robroy Stahlin, supplier of high-performance, non-metallic, waterproof housings for electrical equipment protection and safety. Stahlin's J Series enclosures, using its patented SolarGuard polyester fibreglass PIN flame retardant materials, can ensure durable protection in extremely harsh environments, such as those fishermen face in the Bering Sea and North Pacific: saltwater, frost, rain, snow, high winds, storms, and temperatures that reach -45°C, UV and chemical resistance. Fire safety is ensured with an NFPA No.101 Class A flame spread index and UL94-5V standards for fire retardancy, achieved through use of alumina trihydrate (ATH) PIN flame retardants.

"Stahlin Non-Metallic Enclosures - The World's Most Specified Enclosure" www.stahlin.com

"Shipyard Protects Electric Components with Fibreglass Enclosures" http://www.maritime-executive.com/pressrelease/Shipyard-Protects-Electric-Components-with-Fibreglass-Enclosures-2014-07-29

Safety and sustainability for aircraft materials



SABIC's Innovative Plastics business has extended its range of PIN flame retardant materials for airline interiors and equipment. CLEAR LEXAN™ XHR2000, XHR2HC1 and XHR2HC2 sheets are transparent polycarbonate materials that offer up to 80% light transmission whilst achieving air industry fire safety and smoke/toxicity standards (e.g. OSU 65/65, FAR25.853, BSS7239, ABD0031). SABIC's LEXAN™ LIGHT F6L306 sheet offers a specific gravity of 0.85 g/cm^3, up to 40% lighter than current polymer materials, is thermotransformable into complex 3D parts down to 0.6mm walls, whilst using PIN flame retardants to achieve FST, Boeing and Airbus toxicity requirements.

SABIC press release 8/4/2015 "SABIC introduces additions to its aircraft interior materials portfolio at the AIX Show I Hamburg" http://www.sabic-ip.com/gep/en/NewsRoom/PressReleaseDetail/april_08_2014_sabicintroduces additionsto.html

Plastics Today "Plastics reduce weight aloft, differentiate airline brands" 15/4/2015 http://www.plasticstoday.com/articles/plastics-reduce-weight-aloft-differentiate-airline-brands-polycarbonate-20150415a

See also SABIC aircraft polycarbonates in pinfa Newsletter n° 33 and SABIC thermoplastics for railway interiors in pinfa Newsletter n° 24.

TCO New Generation criteria out for comment

TCO CERTIFIED NEW GENERATION
TCO Certified Displays 7
Draft open for comments

TCO, the health, environment and worker protection label, has published draft "New Generation TCO Certified" criteria for seven additional product categories: Notebooks, Tablets, Smartphones, Desktops, All-in-One PCs, Projectors, Headsets. Drafts will open for comment until 1st September 2015. The TCO New Generation criterial focus on "sustainability throughout the product life cycle" and target in particular buyers under the EU Public Purchasing Directive 2014. TCO's summary of major criteria changes indicates "*Halogens have been largely phased out of IT products – but we need better information about alternative substances being used to replace them. … It is important to know more about the content of these substances and to make sure that [they] do not include other risks*". PIN flame retardants are authorised, subject to being on the publically available Accepted Substance List for TCO Certified, which means having a GreenScreen assessment with benchmark 2 or higher (see pinfa Newsletter n° 41). This follows the TCO decision to authorise a number of PIN flame retardants in all IT product categories (see pinfa Newsletter n° 44).

TCO http://tcodevelopment.com/new-generation-tco-certified/

"New General additional product drafts out now" http://tcodevelopment.com/news/new-generation-additional-product-drafts-out-now/

"Summary of major changes" in the New Generation TCO Certified http://tcodevelopment.com/files/2015/03/new-generation-tco-certified-draft-criteria.pdf

Fire risk of China train seats

Large-scale fir tests of seats from China's CRH1 High Speed Train showed that they are "relatively easy to ignite" and burn reaching 600°C in <2 minutes. The seats' synthetic fibre covering was "easy to ignite with radiant heat" and then the polyurethane filler showed flames which "spread rapidly". Smoke released reduced light transparency to <25%. The authors conclude that fire behaviour of seats is important for minimising risks to train passengers and crew. Unlike China, Europe has strict fire safety and smoke emission requirements for railway fittings and seats (EN 45545, 2013).

"Combustion performance of flame-ignited high-speed train seats via full-scale tests', J. Zhu et al., Case Studies in Fire Safety, accepted manuscript 2015, http://dx.doi.org/10.1016/j.csfs.2015.05.002

US regulatory and media

Minnesota State has enacted legislation (SF1215) banning four flame retardants (TDCPP, Deca-BDE, HBCD, TCEP) in children's products and in upholstered furniture: search SF1215 at *http://www.leg.state.mn.us/leg/legis.aspx* - **Media** are **targeting 'TRIS'** (brominated TRIS, which was banned from children's clothing in the USA in 1977, and chlorinated TRIS = TDCPP), see e.g. New York Times video and article *http://www.nytimes.com/2015/05/04/us/a-flame-retardant-that-came-with-its-own-threat-to-health.html* - **EHHI's "Flame retardants: the case for policy change"** presents the organisation's vision on certain FRs *http://www.ehhi.org/flame/* - **Ecology Centre** test of 15 car seats, in the majority of which flame retardants were found, stating that alternative flame retardants require more study *http://www.ecocenter.org/healthy-stuff/hidden-hazards*

Other News

PFRs do not accumulate in lipids: Concentrations of 3 chlorinated (TCEP, TDCPP, TCIPP) and 3 PIN phosphorus FRs (TBOEP, TPHP, EHDPHP) were analysed in flesh from 170 Yellow eels caught in freshwater in Flanders, Belgium. PFR levels varied with industrialisation of river catchment, with median total PFR levels of 8 parts per billion (44 ng/g w/w), lower than levels of PBDEs or HBCD. In contrast to these brominated FRs, PFR levels were not related to eel flesh lipid content, suggesting that PFRs do not bioaccumulate in lipids. Human exposure from eel consumption is not considered significant.

"Organophosphorus flame retardants in the European eel in Flanders, Belgium: Occurrence, fate and human health risk", G. Malarvannan et al. Environmental Research 140 (2015) 604–610 http://dx.doi.org/10.1016/j.envres.2015.05.021

Biomonitoring of FRs in hair: 2 chlorinated and 7 PIN phosphorus flame retardants were analysed in hair from 48 mothers and 54 children, and compared to levels in urine and in air and dust in the family's home. Levels in hair ranged from <0.001 to 4 µg/g. For some of the FRs, hair concentrations were correlated to levels in dust, for others they were correlated to levels in air. The authors conclude that hair could provide a useful bio-indicator of phosphorus FR exposure, but that the small sample in this study does not allow full conclusions.

"Assessment of human hair as an indicator of exposure to organophosphate flame retardants. Case study on a Norwegian mother–child cohort", A. Kucharska, Environment International 83 (2015) 50–57 http://dx.doi.org/10.1016/j.envint.2015.05.015

PFRs in sewage: 24-hour inflow samples from 11 Australia sewage works were compared to census population data. 13 phosphorus flame retardants (PFRs) were analysed. Total PFR in raw sewage was calculated to be c. 2 mg PFR / person / day.

"Wastewater analysis of Census day samples to investigate per capita input of organophosphorus flame retardants and plasticizers into wastewater", J. O'Brien et al., Chemopshere 138, pp. 328-334, 2015 http://dx.doi.org/10.1016/j.chemosphere.2015.06.014

CertiPUR-US: the voluntary certification program for foam used in bedding and furniture, CertiPUR-US, has announced an extension of its list of excluded flame retardants. The program fixes standards for chemicals used, emissions and durability for polyurethane foams. CertiPUR-US underlines that the program does not mean that foams do not contain flame retardants, but that they are screened.

Furniture World, 26/5/2015: "CertiPUR-US Adds 3 Flame Retardant Additives To Prohibited Substances List" http://www.furninfo.com/Furniture%20Industry%20News/4791

CertiPUR-US: "A Health Check-Up for Foam" http://certipur.us/for-consumers/

Trade Unions call for tighter smoke toxicity regulations: the alliance of fire fighters' trade unions from 12 European countries (EFFUA www.effua.org) has called on the European Union "*to introduce tough new smoke toxicity regulations for construction materials, funding for further studies into the issue of fire fighters and work-related cancer and extra resources to improve health training for fire fighters*". PIN flame retardants can reduce smoke, by preventing fire ignition and slowing development, and also reduce smoke corrosivity.

European Firefighter Unions Alliance (EFFUA) Press Release 4/3/2015 http://www.effua.org/news/80-effua-press-release-4-march-2015

IFSECFIRE "EU Urged to Take Action Over High Cancer Rates Among Firefighters" http://www.ifsecglobal.com/eu-urged-to-take-action-over-high-cancer-rates-among-firefighters/

Tuesday 3rd November 2015 – Brussels

pinfa stakeholder & industry workshop:
Building the future for flame retardants in B&C (building and construction)

Information: pinfa secretariat and www.pinfa.eu

Developments in fire safety and PIN flame retardant solutions
Regulators
Insurers
Architects and construction industry
PIN flame retardant producers and users – compounders – construction and insulation products
Scientists – experts - NGOs
Fire standards – Construction Products (CPL / CPR) – harmonisation
Smoke emissions, toxicity and corrosivity
Green buildings and ecolabels – indoor air quality

***Publisher information**: This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.*
***Abbreviations**: See pinfa website: http://pinfa.org/index.php/15-glossary-of-abbreviations*

Agenda

Events with active pinfa - pinfa-na participation are marked: ►

15-16 Sept	Braunshweig, Germany	Braunschweiger Brandschutz-Tage http://www.brandschutztage.info/
28-30 Sept	Cambridge, UK	6th International Symposium Human Behaviour in Fire http://www.intersciencecomms.co.uk/html/conferences/hb/hb15/hb15.htm
5-7 Oct	New Delhi	Fire India http://www.fire-india.com/
5-7 Oct	Tsukuba, Japan	10th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) http://www.iafss.org/10th-aosfst/
14-16 Oct	Izmir, Turkey	COST MP1105 Workshop on "Flame Retardancy Applications and Related Regulations for Protective Textiles" COST.MP1105@UGent.be and International Technical Textiles Congress (6th ITTC) www.ittc2015.com
19-20 Oct	Düsseldorf	European fire retardant coatings conference (EC European Coatings) http://www.european-coatings.com/Events/European-Coatings-CONFERENCE-Fire-retardant-coatings
3 Nov	Brussels	**►pinfa workshop Building the future for flame retardants in B&C (building and construction)** www.pinfa.eu
4 Nov	Brussels	►pinfa General Assembly
8-10 Dec	Cologne, Germany	Fire Resistance in Plastics 2015 (AMI) http://www.amiplastics.com/events/event?Code=C673
2016		
1-2 March 2016	Cologne, Germany	Sustainable Plastics 2016, from sourcing to end of life recovery (AMI) https://www.amiplastics.com/events/event?Code=C706
26-27 April 2016	Montreal, Canada	**►pinfa-na industry seminar: flame retardancy of materials for surface transportation** http://pinfa-na.org/
3-4 May 2016	Pittsburgh Pennsylvania	AMI Fire Retardants in Plastics http://www.amiplastics-na.com/events/
11-13 May 2016	Lund, Sweden	FSF 2nd Fire Safety of Facades Int. Conference http://www.facade2016.org/
8-10 June 2016	Princeton, USA	SiF'16 Structures in Fire http://www.structuresinfire.com/corpo/conferences.html
13-16 June 2016	Las Vegas	NFPA Conference & Expo http://www.nfpa.org/training/events-calendar
4-6 July 2016	London	Interflam 2016 (14th International Conference and Exhibition on Fire Science and Engineering) www.intersciencecomms.co.uk
29-30 Sept 2016	London	ICFSST 2016 : 18th International Conference on Fire Safety Science and Technology https://www.waset.org/conference/2016/09/london/ICFSST/call-for-papers

pinfa

September 2015 – N° 55

Newsletter for non-halogen fire safety solutions

Innovation

Aircraft fire safety success

170 people escaped safety from a British Airways Boeing 777-200 plane whose engine caught fire during preparation for take-off at Las Vegas airport, Tuesday 8th September. Only minor injuries mainly resulting from the escape slides were incurred. The rapid evacuation of the plane and the fast arrival of the airport's fire services showed the effectiveness of the airline company and airport staff. After extinction of the fire, the plane showed no structural damage to the body. The incident indicates, once again, that despite the unavoidable risks of highly flammable jet fuel, aircraft offer life-saving fire-safety performance. High material fire safety standards, including through use of flame retardant, contribute to this fire safety performance.

Media, photos and videos: http://www.news.com.au/travel/travel-updates/a-british-airways-boeing-777-has-caught-fire-while-preparing-for-takeoff-from-las-vegas/story-fnizu68q-1227518992477 and http://abcnews.go.com/US/print?id=33614813

German fire services often fail to reach fires in time

An investigation by German TV Das Erste (PlusMinus 2/9/2015) shows that in 40% of cities of over 100 000 population in Germany, fire services are not achieving the official intervention time objective which is to reach the fire within 8 minutes of the alarm in 90% of cases. This is estimated to give a total of 17 minutes to extract occupants, assuming 5 minutes from the fire starting to the alarm and 4 minutes on site for fire fighters to reach occupants. The film underlines that this time is critical, given the rapid spread and development of fires in modern homes, showing deaths and injuries in fires in Bremen (a fire starting in a home caused by a defective electric heater), Dortmund and Berlin. This confirms the importance of slowing fire development to increase escape time and fire brigade intervention time, for which PIN FRs can play a critical role (see “Do flame retardants work” in pinfa Newsletter n° 54).

Die Erste, 2 September 2015, PlusMinus (in German)
http://www.daserste.de/information/wirtschaftboerse/plusminus/sendung/plusminus-02-09-schutzziele-feuerwehr-100.html

pinfa-na Flammability Requirements in Construction

pinfa-na (North America) held its 3rd annual industry day conference in Tampa, Florida, 15-16 April 2015. It focused on the commercial building and construction industry and was co-sponsored by the National Pollution Prevention Roundtable (www.p2.org). The meeting brought together a diversity of stakeholders, enabling lively and constructive discussions. Mark Goulthorpe, architect at Massachusetts Institute of Technology (MIT) indicated that global population growth and economic advancement will result in a doubling of the built environment in the next 20-30 years, necessitating new paradigms and approaches to green building and energy consumption. The use of composite materials will continue to develop, and new fire safety solutions will be needed in these applications. Ashley White of U.S. Green Building Council (USGBC) presented “New opportunities for green building materials in the LEED v4 rating system**”.** Shari Kram of the Dow Chemical Company presented information concerning “sustainable” polymeric brominated flame retardants for rigid polystyrene foam insulation, intended to replace the brominated flame retardant HBCD which is being phased out in different regions of world due to environmental and health concerns.

pinfa North America http://pinfa-na.org/ The next (4th)pinfa-na annual industry day will take place in Montreal Canada on 26-27 April 2016 on flame retardancy of materials used in surface transportation (i.e. rail, bus & automotive).

Lanxess PIN FR polyamide electrical automobile safety

Lanxess is showcasing new applications for its non-halogenated PIN flame retardant polyamide Durethan range. The range includes non-reinforced, glass fibre and mineral reinforced, PA6, PA66 and up to 15% consumer recycled polymer formulations, adapted for injection molding with good flow characteristics. Different formulations can be adapted to laser marking or offer specific surface finishes. Durethan BKV 20 FN01 uses phosphorus-based fire safety technology, achieving UL94 V0 (0.75mm) fire performance classification, and is adapted for injection molding of performance, high-voltage components in electrical vehicle battery systems.

"LANXESS at the VDI conference "Plastics in Automotive Engineering", March 18 and 19, 2015, in Mannheim. High-tech composites for lightweight construction" http://lanxess.com/en/corporate/media/press-releases/trade-technical/2015-00009e/?type=98 and https://techcenter.lanxess.com/scp/emea/en/products/description/47/index.jsp?pid=47

Rail fire safety success

In two cases in August, high speed trains have caught fire in their engine compartments in France, near Lyon 21st August and near Montpellier 2nd August. In both cases, all passengers and crew exited in safety, respectively 800 and 300 people.

Media:
http://www.lemonde.fr/societe/article/2015/08/21/importants-retards-sur-la-ligne-paris-marseille-apres-un-incendie-dans-un-tgv_4733008_3224.html
and http://france3-regions.francetvinfo.fr/languedoc-roussillon/herault/lunel/les-experts-ouvrent-l-enquete-sur-l-origine-de-l-incendie-du-tgv-espagnol-lunel-781241.html

Fire Retardants in Plastics 2015

The AMI conference on Fire Retardants in Plastics took place in Denver, Colorado, May 12-13, 2015 with around 160 participants. Eighteen papers were presented by scientists, industry and stakeholders. The U.S. EPA presented an update of flame retardant evaluations, stating that it just had launched a new tool during January 2015 called "OECD Substitution and Alternatives Assessment Toolbox" (www.oecdsaatoolbox.org) pinfa member companies FRX Polymers and Clariant respectively presented "Flame retardant thermoplastic elastomers based on synergistic combinations of phosphonates and other flame retardants" and "Halogen-free flame retardants for aliphatic and semi-aromatic polyamide formulations". Underwriter Laboratories (UL LLC) presented the latest information concerning advances in microscale combustion calorimetry, originally developed by Richard Lyon of U.S. FAA to investigate polymeric materials for use in aviation, which is beginning to see commercial application. Milliken Co. presented a new technology incorporating Nylon and polyester into FR textiles and garments, combining flame retardant performance with apparel comfort.

AMI Fire Retardants in Plastics http://www.amiplastics-na.com/events/
Next year's conference: Pittsburgh, Pennsylvania, May 3-4, 2016.

PIN Flame retardant cable ties for rail and air safety standards

Thomas & Betts (part of the ABB group) offers Ty-Rap® cable ties conform to railway and air industry performance and fire safety requirements. The PIN flame retardant (non halogenated) cable ties are based on polyamide 6.6 with a 316 stainless steel locking barb and respect ASTM E162 for surface flammability, E662 for smoke density and E1354 for heat and smoke release, Boeing and Bombardier standards for combustion-generated gases and NFPA130 standard for railways (Fixed Guideway Transit and Passenger Systems). The ties meet UL94V-0 or UL94V-2, temperature and UV resistance depending on specifications. Smooth and rounded edges avoid pressure points and solid bodies without notches eliminate cables stress, so ensuring longer safe cable life. Ribbed and stippled surfaces prevent cables moving under vibration or shock.

"Flame-Retardant and Heat-Stabilized/UV-Resistant Ty-Rap® Cable Ties Meet Railway Industry Safety Requirements" 28th July 2015 http://www.tnb.com/pub/en/node/2011

Saco offers new cable solution for offshore and marine

SACO AEI has launched SX-0606 HFFR (PIN flame retardant) moisture-cure, silane, cross-linkable sheathing compound for cables for demanding offshore, marine and related industrial installations. The compound offers easy, high-speed processing, quality cable surface finish, high flexibility, mud resistance, and meets NEK606 standard (Norwegian industry standard for offshore oil, gas, ship and marine industries). It is available natural, pre-coloured or black (UV resistant). Low smoke and fume fire retardancy contributes to crew and passenger safety in marine applications. SX-0606 can be combined with a flexible insulating compound SX-554 ethylene propylene rubber (EPR) and high Limiting Oxygen Index (LOI) bedding to achieve exceptional fire performance, oil resistance and cable flexibility.

"SX-0606 HFFR moisture curable solution to meet stringent requirements of NEK606" http://www.aeicompounds.com/news/view/144

Bio-based phosphorus and sulphur PIN FRs for epoxies

Novel additive and reactive PIN FRs, containing phosphorus and sulphur, were synthesised from a bio-based phenolic compound (phloroglucinol) and tested at 1 – 3 % loading in epoxy resin DGEBA-IPDA. Results show that the PIN FRs significantly reduce pHRR (peak heat release rate), THR (total heat release) and EHC (effective heat of combustion). The additive PIN FR version shows a plasticising effect on the epoxy resin (lowering of the glass transition temperature Tg) whereas the reactive FR version reduces the epoxy functionality of the resin but shows better fire protective char formation. Both versions show strong intumescent fire protection effects, by generating expanded, insulating residue on the polymer surface (char). The authors conclude that bio-based phenolic phosphorus sulphur PIN FRs offer significant potential for fire safety treatment of epoxy resins, with reactive versions showing most promise.

"Synthesis of biobased phosphorus-containing flame retardants for epoxy thermosets comparison of additive and reactive approaches", Polymer Degradation and Stability 120, 2015 , R. Ménard et al. http://www.sciencedirect.com/science/article/pii/S014139101530046X

See also Ménard et al. I pinfa Newsletter n° 47

BCC Flame Conference Stamford

The 26th BCC annual conference Recent Advances in Flame Retardancy of Polymeric Materials, Stamford, USA, 17-20 May 2015, included nearly 50 science and industry presentations on new flame retardant technologies and markets. Marcelo Hirschler (GBH) presented comprehensive updated evidence as to the beneficial impacts of flame retardants in increasing escape time, saving lives and improving fire fighter intervention (see pinfa Newsletter n°54 "Do flame retardants improve fire safety?"). Marcanne Green, BCC Research, indicated that the flame retardant market is expected to continue to grow over the coming five years, especially in plastics. In particular, there will be demand for fire safety solutions based on mineral PIN FRs (e.g. ATH aluminium tri hydrate) and phosphorus PIN FRs. Recycling is expected to become increasingly important in defining polymer and FR solutions. New investments will tend to make FRs "greener". Research developments in PIN FRs presented included phosphonates, sulfonate-POSS, hydroxy functional organophosphorus oligomer, a one-pot water-based P+N FR solution for cottons (APP + melamine), bio-sourced lignin modified with TPP, silica-nickel-aluminium hydroxide FR with smoke reduction performance, DOPO + melamine synergy (PIN phosphorus + nitrogen), bio-based polyols with PIN phosphorus, as well as bio-based phosphorus FRs in epoxies

BCC 2015 conference abstracts http://www.bccresearch.com/conference/flame-conference-brochure

PIN FR Nylon for solar electrical applications

Radici, Italy's, new Radiflam® ARV250 HF 3003 Black PIN flame retardant 25% glass-reinforced Nylon 66 has been specially developed for solar photovoltaic power applications, such as supports and housings for DC/AC inverters. These applications involve large parts with good weathering, quality surface properties and minimal offgasing to protect electrical components. The new product adds to Radici's existing range of flame retardant thermoplastics and engineering plastics adapted to different applications and performance requirements, including the Radiflam® RV-FR products which use inorganic PIN flame retardants in polyamide 6 or 66 to achieve fire performance levels required for transport and railway applications and low smoke optical density and toxicity.

"Materials at NPE: New Solutions to Enhance Processing, Performance, Sustainability & Cost" http://www.ptonline.com/articles/materials-at-npe-new-solutions-to-enhance-processing-performance-sustainability-cost

Radici Radiflam® http://www.radicigroup.com/en/products/plastics/flame-retardant-radiflam

Zinc oxide synergist for PIN FR phenolic foams

PIN flame retardant high-solid phenolic foams were tested with 0 to 5% zinc oxide. The PIN FR foam contained 10% APP (ammonium polyphosphate, phosphorus – nitrogen FR) and 5% PER (penta erythritol, carbon source for char formation) and showed significantly improved fire performance (LOI – Limiting Oxygen Index, HRR – Heat Release Rate, THR – Total Heat Release, EHC – Effective Heat of Combustion) and also reduced toxic gas (carbon monoxide) production and yield (COP, COY) compared to non flame retarded foam. Optimum zinc oxide load was c. 1%, resulting in reduced mean toxic gas release whilst not significantly deteriorating the foam physical properties (bending and compression strength).

"Effect of zinc oxide on properties of phenolic foams/halogen-free flame retardant system", Journal of Applied Polymer Science, 2015, Y. Ma et al., http://onlinelibrary.wiley.com/doi/10.1002/app.42730/abstract

IEC proposes “Low halogen” definition

International Electrochemical Commission’s (IEC), the electronics industry organisation, is proposing a definition of “Low Halogen” for materials used in electronic and electrical products (proposal circulated 28/8/2015 refs. 111/383A/NP). This will complete the organisation’s existing definition of “Halogen-Free” IEC 61249-2-21 and is coherent with JEDEC JS709B (microelectronics industry organisation) definition of "Low Halogen" Electronic Products. The stated objective is to respond to the concern to current confusion in the market because of varying vocabulary such as "Halogen Free", "Low Halogen", "Zero Halogen", "Non Halogenated", "Non-chlorine and Non-bromine", Halogen Poor etc. IEC 61249-2-21 specifies for “Halogen-Free” materials limits of 900 ppm maximum chlorine, 900 ppm maximum bromine and 1500 ppm maximum total chlorine plus bromine (irrespective of whether halogens are of organic or inorganic origin or nature). JEDEC JS709B specifies for “Low Halogen” materials limits of <1000 ppm of bromine and <1000 ppm chlorine for halogens from flame retardants or PVC, but with higher levels of halogens allowed if they are from other sources. **Consultation on 111/383A/NP is open to 2/10/2015**

IEC 111/383A/NP Low Halogen Materials used in Electronic and Electrical Products
http://www.iec.ch/dyn/www/f?p=103:30:0::::FSP_ORG_ID,FSP_LANG_ID:1314,25

JEDEC JS709B Definition of "Low Halogen" Electronic Products (June 2015). http://www.jedec.org/standards-documents/docs/js709b

Biobased engineering plastic for automobiles

DSM’s EcoPaXX Q-KGS6 non-halogenated PIN flame-retardant formulation has been selected by Dytech-Dynamic Fluid Technologies for fuel vapour separators for Ferrari and Maserati sports cars. The product offers mechanical performance, chemical resistance and low moisture absorption, as well as improving fire safety. DSM’s EcopaXX® range is also a benchmark for environmental quality, responding to automobile and other industry requirements for Life Cycle Assessment. The base polymer is a 70% bio-sourced long-chain polyamide PA410, offering high melt point and crystallisation rate. The polyamide is produced from tropical castor beans (Ricinus communis) which do not compete with the food chain. It is certified 100% carbon neutral cradle-to-gate.

See also DSM’s Stanyl® PIN FR range, pinfa Newsletter n°25

See: http://www.dsm.com/markets/automotive/en_US/products-brands/ecopaxx.html and www.ecopaxx.com

Regulatory news

ECHA (European Chemical Agency) has recommended to add 15 substances to the REACH “authorisation list” (list of substances banned in Europe except in specifically licensed cases). The “recommendations” are effectively substances pending ECHA formal decision as to addition or not to the “authorisation list”. This adds to 12 substances already awaiting decision. The 15 added substances include four boron substances (boric acid; disodium tetraborate, anhydrous; diboron trioxide; and tetraboron disodium heptaoxide, hydrate) and the solvent 1-bromopropane (n-propyl bromide). ECHA’s Risk Assessment Committee has also concluded its assessment of DecaBDE, supporting ECHA’s proposal

already made to restrict the substance's use and ECHA has issued a draft "Restriction report" for the substance.

ECHA statement *http://echa.europa.eu/view-article/-/journal_content/title/echa-proposes-15-substances-for-authorisation and recommendation http://echa.europa.eu/documents/10162/13640/6th_a_xiv_recommendation_01july2015_en.pdf ECHA Risk Assessment Committee (RAC) conclusions summary 11/6/2015 http://echa.europa.eu/documents/10162/21774240/Annex_RAC_33.pdf ECHA Annex V Restriction report (proposal v1.0, 1st August 2015) http://echa.europa.eu/documents/10162/a3f810b8-511d-4fd0-8d78-8a8a7ea363bc*

Chemicals and the circular economy. The European Union is currently discussing proposals to develop the "circular economy". The Ellen MacArthur Foundation estimates that moving to growth based on recycling and reuse rather than consumption of resources could benefit the EU nearly 1 trillion €/year. Increasing recycling of polymers raises challenges for flame retardants, both to ensure that tomorrow's polymer-FR combinations are recyclable, and also how to deal with chemicals "from the past" present in polymers in end-of-life products to be recycled today. CHEM Trust (UK), for example, suggests that the circular economy will accelerate development of chemicals with safer toxicity profiles.

EU circular economy policy proposals http://ec.europa.eu/environment/consultations/closing_the_loop_en.htm

"Growth Within: a circular economy vision for a competitive Europe", 100 pages, 25th June 2015, Ellen MacArthur Foundation, McKinsey Center for Business and Environment, SUN (Stiftungsfonds für Umweltökonomie und Nachhaltigkeit) http://www.ellenmacarthurfoundation.org/news/latest-researchreveals-more-growth-jobs-and-competitiveness-with-a-circulareconomy

CHEM Trust, 19/8/2015 "The Circular economy: To get it right we must address hazardous chemicals " http://www.chemtrust.org.uk/the-circular-economy-to-get-it-right-we-must-address-hazardous-chemicals/

ECHA finalises **restrictions on ammonium salts in cellulose insulation**. ECHA's Socio-Economic Analysis Committee (SEAC) adopted a final Opinion on a Restriction dossier on ammonium salts used as flame retardants in cellulose insulation, extending somewhat the proposed implementation deadline. pinfa input into this decision process (see pinfa Newsletter n° 48) confirming that proposed restrictions made sense, to avoid risks of ammonia gas release in certain conditions (high humidity and temperature, pH) which could cause irritation to the respiratory tract and eyes (e.g. building workers installing insulation in enclosed spaces). pinfa emphasises that ammonium salts are recognized to be non-toxic and have been developed as safer alternatives to previously used chemicals: this operational issue is the only risk with their use, and they have no long-term or chronic toxic effects, are not carcinogenic, mutagenic, teratogenic or impacting on the immune system.

ECHA/NA/15/19, 16/6/2015 "Restriction proposal on ammonium salts" http://echa.europa.eu/view-article/-/journal_content/title/seac-concludes-on-two-restriction-proposals-and-agrees-on-two-draft-opinions-on-applications-for-authorisation

The **US Environmental Protection Agency** has updated its TCSA (Toxic Substances Control Act) Work Plan, announcing that full risk assessments will be carried out for four halogenated flame retardants: TBB, TBPH, TCEP, HBCD. EPA will also start data collection on 8 other flame retardants.

EPA TCSA Work Plans http://www.epa.gov/oppt/existingchemicals/pubs/workplans.html and http://www.epa.gov/oppt/existingchemicals/pubs/riskassess.html and consultations opened for 60 and 120 days on 12th August 2015 http://www.epa.gov/oppt/existingchemicals/pubs/PrePubCopy_15T-0164.pdf

Tuesday 3rd November 2015 – Brussels

pinfa stakeholder & industry workshop:
Ensuring the Fire Safety and Sustainability of Construction Materials:
the Role of Flame Retardants

Information: pinfa secretariat and www.pinfa.eu

Developments in fire safety and PIN flame retardant solutions
Regulators
Insurers
Architects and construction industry
PIN flame retardant producers and users – compounders – construction and insulation products
Scientists – experts - NGOs
Fire standards – Construction Products (CPL / CPR) – harmonisation
Smoke emissions, toxicity and corrosivity
Green buildings and ecolabels – indoor air quality

***Publisher information**: This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.*
***Abbreviations**: See pinfa website: http://pinfa.org/index.php/15-glossary-of-abbreviations*

Agenda

Events with active pinfa - pinfa-na participation are marked: ►

28-30 Sept	Cambridge, UK	6th International Symposium Human Behaviour in Fire http://www.intersciencecomms.co.uk/html/conferences/hb/hb15/hb15.htm
5-6 Oct	Berlin	1st Workshop on Fire Safety of Bio-Based Building Products http://www.costfp1404.com/en/ourevents/Sidor/default.aspx
5-7 Oct	New Delhi	Fire India http://www.fire-india.com/
5-7 Oct	Tsukuba, Japan	10th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) http://www.iafss.org/10th-aosfst/
14-16 Oct	Izmir, Turkey	COST MP1105 Workshop on "Flame Retardancy Applications and Related Regulations for Protective Textiles" COST.MP1105@UGent.be and International Technical Textiles Congress (6th ITTC) www.ittc2015.com
19-20 Oct	Düsseldorf	European fire retardant coatings conference (EC European Coatings) http://www.european-coatings.com/Events/European-Coatings-CONFERENCE-Fire-retardant-coatings
3 Nov	Brussels	**►pinfa workshop: Ensuring the Fire Safety and Sustainability of Construction Materials - the Role of Flame Retardants** www.pinfa.eu
4 Nov	Brussels	►pinfa General Assembly
4-5 November	Glasgow, Scotland	Fire and Materials Seminar on Bromine Flame Retardants - Life-Savers or Eco Villains? http://www.soci.org/~/media/Files/Conference%20Flyers/FINAL_flyer%20_Bromine%20flame%20retardants.ashx
8-10 Dec	Cologne, Germany	Fire Resistance in Plastics 2015 (AMI) http://www.amiplastics.com/events/event?Code=C673
	2016	
1-2 March 2016	Cologne, Germany	Sustainable Plastics 2016, from sourcing to end of life recovery (AMI) https://www.amiplastics.com/events/event?Code=C706
6-4 April	Dublin	Sustainable Fire Engineering Benchmark Event (Regional SBE16/17) http://sustainable-firengineering.ie/
26-27 April 2016	Montreal, Canada	**►pinfa-na industry seminar: flame retardancy of materials for surface transportation** http://pinfa-na.org/
3-4 May 2016	Pittsburgh Pennsylvania	AMI Fire Retardants in Plastics http://www.amiplastics-na.com/events/
11-13 May 2016	Lund, Sweden	FSF 2nd Fire Safety of Facades Int. Conference http://www.facade2016.org/
15-19 May	Lisbon	47th Annual Meeting of the International Research Group on Wood Protection http://www.irg-wp.com/irg-news-and-events.html
23-26 May 2016	Stamford CT	Recent Advances in Flame Retardancy of Polymeric Materials http://www.bccresearch.com/conference/flame
8-10 June 2016	Princeton, USA	SiF'16 Structures in Fire http://www.structuresinfire.com/corpo/conferences.html
13-16 June 2016	Las Vegas	NFPA Conference & Expo http://www.nfpa.org/training/events-calendar
4-6 July 2016	London	Interflam 2016 (14th International Conference and Exhibition on Fire Science and Engineering) www.intersciencecomms.co.uk
29-30 Sept 2016	London	ICFSST 2016 : 18th International Conference on Fire Safety Science and Technology https://www.waset.org/conference/2016/09/london/ICFSST/call-for-papers

pinfa
Phosphorus, Inorganic & Nitrogen Flame Retardants Association

Your newsletter for non-halogen fire safety solutions
October 2015 – No. 56

pinfa stakeholder & industry workshop on Tuesday 3rd November 2015 – Brussels

Ensuring the Fire Safety and Sustainability of Construction Materials: the Role of Flame Retardants

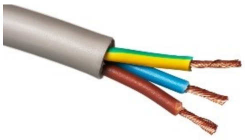
Information: pinfa secretariat and http://pinfa.org

- Developments in fire safety and PIN flame retardant solutions
- Regulators
- Insurers
- Architects and construction industry
- PIN flame retardant producers and users – compounders – construction and insulation products
- Scientists – experts - NGOs
- Fire standards – Construction Products (CPL / CPR) – harmonisation
- Smoke emissions, toxicity and corrosivity
- Green buildings and ecolabels – indoor air quality

Bus and coach fires in Sweden

Every year, one in 140 buses and coaches on Sweden's roads suffers a (reported) fire incident: that is over 100 reported fires annually. SP (Technical Research Institute of Sweden) estimates that there are over 200 bus and coach fires per year, when unreported fires are included. The number of bus fires nearly doubled from 1996 to around 2006, then has fallen somewhat through to 2013, but still remains significantly higher than in the mid 1990's. The increase in fires may be related to noise and emissions requirements, which lead to temperature increases in the engine compartment. 61% of bus and coach fires started in the engine compartment, and 20% in the wheels. 7% of the bus and coach fires led to flashover (vehicle completely engulfed in flames). Sweden's 14 000 buses and coaches travelled an average 63 000 km per year, four times further than cars and 30% further than heavy goods vehicles. Experts have repeatedly underlined that materials fire safety requirements in buses and coaches are considerably lower than those for railways or shipping, see e.g. French Railways at FIVE 2014 (pinfa Newsletter n°47) "Why are such lax fire standards in coaches and buses are tolerated by governments, vehicle manufacturers and operators and by the public?"

"Bus fires in Sweden 2005 – 2013", A. Rakovic et al., SP Sweden, SP Report 2015:43
http://publikationer.extweb.sp.se/user/default.aspx?lang=eng&TechArea=4



Performance PIN FR cables for industrial equipment

LAPP's new Ölflex® SERVO FD796 motor cable uses halogen-free flame retardant (HFFR) polyolefin insulation to achieve new standards in compactness, flexibility and reliability, for applications in automated machinery which undergoes repeated and rapid movements. The 'Seven in One' element cable can replace 7 standard cables and offers acceleration up to 50 m/s^2 and movement speeds up to 5m/s with considerably reduced run-up and breaking times. The PIN FR polyolefin offers electrical performance with low capacitance and low electromagnetic leakage currents. LAPP underlines that HFFR cables are lighter, so reducing machinery weight, are more environmentally friendly, reduce smoke release and avoid release of toxic and acidic halogenated substances in smoke in case of fire.

Lapp Group is a leading cable manufacturing since 1957, with 17 production sites worldwide.
http://www.lappnews.co.uk/premium-servo-cable-by-olflex/
http://www.lappnews.co.uk/why-use-low-smoke-zero-halogen-cables/

Continuing growing demand for flame retardants

The global market for flame retardants is expected grow at 5 to 11% per year over the next 5-7 years, according to two different market reports. **Ceskaa** predicts growth of 5.2% to 2020 due to stricter fire safety regulations, led by the Asia-Pacific region and by increasing demand for non-halogenated FRs. **Big Market Research** predicts growth of 11 % per year to 2022, driven by new and emerging applications and technologies and by the construction and automobile markets. **Transparency Market Research** estimates that to 2020 the market for specialist flame resistant fabrics is expected to grow 6.7%/year, driven by regulations in industries such as chemicals and oil and gas production, and by the expansion of the oil and gas sector worldwide. **Future Market Insights** estimates growth in the PIN FR melamine phosphate of 5 – 8% per year to 2025, with a wide range of applications including rubber, plastics, paints, epoxy, wood and paper. **HexaReports** estimates that the global market for “low smoke halogen free flame retardant” polypropylene will grow at 7.8% per year to 2020, driven by construction, automobile and E&E industries, with key challenges being to improve the loading levels and process ability of PIN flame retardants.

“Global market for flame retardants 2015-2020”, CHEM-15-01 *www.ceskaa.com*

“Global Flame Retardant Chemicals Market Outlook (2014-2022)” *www.bigmarketresearch.com/*

“Melamine Pyrophosphate Market: Global Industry Analysis and Opportunity Assessment 2015-2025” *www.futuremarketinsights.com/*

“Flame Resistant Fabrics Market for Industrial Protective Clothing, Law Enforcement and Firefighting Services, Transport and Other Applications - Global Industry Analysis, Size, Share, Growth, Trends and Forecast, 2014 – 2020” *www.transparencymarketresearch.com/*

“Low Smoke Halogen Free Flame Retardant Polypropylene (PP) Market Analysis By Application (Construction, Automotive, Electrical & Electronics, Industrial), And Segment Forecasts To 2020” *http://www.hexareports.com*

Nexans cables protect sprinklers and fire exits

Nexans has enhanced its Alsecure® range of fire-resistant, PIN FR technology, low smoke cables with the new NX600 cables, for 30, 60 and 120 minute applications as defined by BS 8519. This means that, in case of fire, the cables will continue to transmit power and communications signals for sprinklers, alarm systems and fire exits for periods long enough to ensure the functioning of these safety installations and the escape of occupants. The NX600 cables use PIN flame retardants to ensure fire performance, they are insulated by mica and cross-linked polyethylene (XLPE), ensuring high temperature resistance and reliability and thin layer insulation, facilitating installation and minimising space use, and they have low smoke and fume bedding and sheathing. Nexans state "*halogen-free quality of the NX600 cable ensures that poisonous gases aren't released during a fire*".

www.nexans.co.uk/nx600

Nexans PIN cables meet extreme conditions

Nexan's new ICEFLEX® cables are a full range of PIN flame retardant marine and offshore cables are designed to resist ultra-cold Arctic temperatures. Applications include offshore drilling and exploration installations, meeting the Canada requirement for cold impact at -45°C and cold bending at -55°C. The halogen-free formulation of both outer insulation and inner sheath ensure low-smoke, low-toxicity and low fire gas emissions. The cables meet fire performance standards IEC 60332-3-22 category "A" and (option) IEC 60331-21/1/2 water spray.

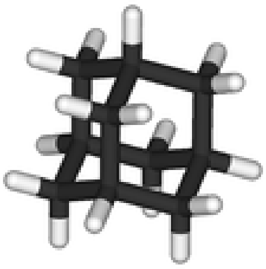
http://www.nexans.be/eservice/Belgium-en/navigate_232142/ICEFLEX_IEC_SHF2_Halogen_free.html

Nexans cables: see also pinfa Newsletters n° 12 and 43

Bio-based phosphorus compounds: state of the art

A 35-page review by Illy et al. summarises current fundamental and applied research into synthesis of phosphorus containing bio-molecules (phosphorylation). Phosphorus containing polymers offer valuable properties including PIN fire safety characteristics, chelating and metal adhesion. The use of bio-based polymers can reduce environmental impacts by using renewable carbon and offering good biodegradability. The review looks at the different families of bio-based chemicals which can be phosphorylated: polysaccharides (e.g. cellulose, chitosan …), biophenols (e.g. lignin), triglycerides (e.g. plant oils, DOPO, cardenol from cashew nuts …), hydroxy acids (e.g. poly lactic acid PLA) and at the different chemical routes for adding phosphorus functionalities to these bio-molecules. The authors note that phosphorylation can be achieved using bio-catalytic methods at low temperatures / low input energy, using enzymes, to enable low toxicity, environmentally preferable synthesis processes.

"Phosphorylation of bio-based compounds: the state of the art", Polymer Chemistry (Royal Society of Chemistry) 2015, N. Illy et al.
http://pubs.rsc.org/en/content/articlelanding/2015/py/c5py00812c#!divAbstract



Adamantane-based P FRs for polycarbonate

Novel phosphorus-based PIN FRs were developed based on the tetrahedral four carbon ring molecule adamantine, which offers a good ecotoxicological profile, high thermal and oxidative stability and good polymer compatibility. One to four phenyl phosphorus molecules were reacted onto adamantine and tested for physical properties and fire performance in PCA (polycarbonate). The 4-P (tetrakis(diphenyl phosphorus adamantine) TKDPaD) showed the best flame retardancy (UL- V0 at 8% weight loading) and good thermal stability. The phosphorus adamantine PIN FRs showed to protect polycarbonate from fire by condensed phase action (char formation) but also slightly by gaseous phase action.

"Novel halogen-free flame retardants based on adamantane for polycarbonate", Royal Society of Chemistry RSC Advances 5, 2015, S-Q. Fu et al.
http://pubs.rsc.org/en/content/articlelanding/2015/ra/c5ra10887j#!divAbstract

US alternative flame retardant assessments

The US Environmental Protection Agency (EPA) has published the final reports for its alternative flame retardant assessments to PentaBDE (penta brominated diphenyl ether) in polyurethane foam (PUF, particularly in furniture) and for alternative FRs in printed circuit boards (PCBs). The EPA DfE (Design for the Environment) on alternative flame retardants for PUF (see pinfa Newsletter n° 22) presents a "hazard" evaluation for 18 alternative flame retardants: 2 brominated, 4 chlorinated and 12 PIN FRs. Based on this report, US EPA has indicated that e.g. the PIN flame retardant Clariant Exolit OP 560, a phosphorus based polyol, is "a safer alternative to pentaBDE" (see pinfa Newsletter n° 44). The report on PCBs presents a "Screening level hazard summary" for TBBPA (tetrabromobisphenol), used in a majority of printed circuit boards, and for 9 alternative FRs (see summary of draft report, December 2014, pinfa Newsletter n° 48). This report also looks at data on release of smoke, particulates, CO and CO_2 for the different flame retardants, showing that the PCBs containing halogenated flame retardants emitted higher emissions of PAH (poly aromatic hydrocarbons), smoke and particulates compared to PCBs with PIN FRs, in incineration and open burn conditions, but those with PIN FRs had higher emissions than boards without flame retardants. Carbon monoxide emissions were similar for flame retarded and non-FR boards and peak heat releases were lower when flame retardants were used.

FRs considered in the USA EPA DfE printed circuit board report (PCBs): 1 reactive brominated FR (TBBPA); 2 reactive P-based PIN, FRs (DOPO, Fyrol PMP); 5 additive PIN FRs (aluminium diethyophospinate, ATH, MDH, melamine polyphosphate, amorphous silicon dioxide); 2 reactive polymeric FRs (DER 500 series - brominated, Dow XZ-92547 - P-based)

US EPA Design for the Environment "[Flame Retardants Used in Flexible Polyurethane Foam: An Alternatives Assessment Update](http://www2.epa.gov)", August 2015, 832 pages

US EPA Design for the Environment "[Flame Retardants in Printed Circuit Boards - Final Report](http://www2.epa.gov)", August 2015, 720 pages, http://www2.epa.gov

Layer-by-layer PIN flame retardancy for cotton fibres

Recent papers show innovative solutions for PIN fire safety treatment of cotton fibres, using layer-by-layer deposition of PIN flame retardant combinations including bio-based chitosan, phosphorylated poly vinyl alcohol (PVA), PHMGM (polyhexamethylene guanidine phosphate) and melamine polyphosphate (MPP) and ammonium phosphate (APP). Chitosan is a widely occurring natural nitrogen-containing polysaccharide (present e.g. in shellfish and crab wastes). PVA is a very biodegradable, water soluble polymer. These two chemicals were deposited onto cotton fabric using a water-based process. 30 bi-layers resulted in significantly improved fire performance (reduced peak heat release, lower volatile organic gas emissions, self-extinguishing). PHMGP and APP were deposited onto cotton fibres in multi-layers, also using an aqueous process (1 minute dipping, 30 seconds rinsing, drying for each layer). 20 bi-layers significantly reduced cotton flammability (but self-extinguishing was not achieved) and also offered anti-microbial properties. Multilayer chitosan and melamine polyphosphate on polyester-cotton fabric was achieved in a water-based process by generating the (water-insoluble) MPP on the fibre surface by reacting aqueous solutions of melamine and sodium hexametaphosphate. 15 bi-layers of chitosan and MPP achieved self-extinguishing on polyester-cotton fabric.

"An eco-friendly way to improve flame retardancy of cotton fabrics: layer-by-layer assembly of semi-biobased substance", H. Pan et al., Energy Procedia 75 (2015) 174 – 179 http://dx.doi.org/10.1016/j.egypro.2015.07.631

"Construction of intumescent flame retardant and antimicrobial coating on cotton fabric via layer-by-layer assembly technology", F. Fang et al., Surface & Coatings Technology 276 (2015) 726–734 http://dx.doi.org/10.1016/j.surfcoat.2015.05.023

"Water-based chitosan/melamine polyphosphate multilayer nanocoating that extinguishes fire on polyester-cotton fabric", M. Leistner et al., Carbohydrate Polymers 130 (2015) 227–232 http://dx.doi.org/10.1016/j.carbpol.2015.05.005

Metal oxide surfacing to reduce fire propagation

The EU project SESBE is developing inorganic Transparent Conductive Oxide (TCO) coatings, based on metal oxides, to reduce the risk of fire propagation for e.g. building façade materials. Thin layers of indium tin oxide or zinc oxide have been shown to delay ignition times of PMMA (poly(methyl methylacrylate) = “plexiglass”) when the coated materials are exposed to thermal radiation (25 kW/m^2). The thin inorganic layers are transparent to visible light, so do not deteriorate the material’s appearance, but reflect long-wave radiation (heat), whereas standard paints absorb up to 90% of heat radiation. The use of such coatings could reduce emitted heat from a burning façade and could delay or prevent ignition of the treated façade materials in case of a nearby fire.

SP Sweden “Brandposten” n°52 (2015)
http://www.sp.se/en/units/fire/brandposten/Sidor/default.aspx

RIP cigarettes are not really safe

Since November 2011, all cigarettes sold in the EU must be “self-extinguishing” (RIP = reduced ignition propensity). A study by SP Sweden (Technical Research Institute of Sweden) for MSB (Sweden’s civil contingencies agency) suggests that cigarettes are continuing to cause a large number of fire-related deaths despite their respecting the specified RIP test (EN16156). SP indicates that the RIP cigarette legislation has not produced any observable effects in relation to either statistics for fire-related deaths or to fire statistics in general. Furthermore, in EN 1201-1 tests with furniture materials and textiles, over 2/3 of tested cigarettes burnt their full length despite being RIP. In some cases they caused materials to start smouldering. SP concludes that “upholstery material, surface fabrics, and the test configuration are factors that have greater impact on ignition propensity than the actual type of cigarette”.

SP Sweden “Brandposten” n°52 (2015) www.sp.se

PIN FRs for polypropylene composites

Polypropylene (PP) offers good physical and mechanical properties, leading to widespread use for applications in transport, electronics and electrical equipment, architectural materials, furniture and interior decorations. The inorganic PIN flame retardant ammonium polyphosphate (APP) offers advantages of low toxicity and low smoke, but poses application challenges including polymer compatibility, migration and moisture resistance. To improve performance of ammonium polyphosphate PIN flame retardant, microencapsulation is increasingly proposed, where APP particles are enclosed in thin polymer layers (e.g. water resistant polymers), enabling improved dosing, polymer integration and stability. The authors take this further, by microencapsulation in alumina-silica hydrogel, so that the enclosing material offers both the microencapsulation functionality, but also flame retardant synergistic effect through presence of silicon and aluminium hydroxide. The synthesised alumina-silica hydrogel double shell microencapsulated ammonium polyphosphate (MDAPP) was tested for fire performance in a polypropylene – polyamide 6 composite, showing improved mechanical properties compared to the composite plus standard APP and achieving UL94 V0 fire rating.

"Microencapsulated ammonium polyphosphate and its application in the flame retardant polypropylene composites", M. Chen et al., Journal of Fire Sciences 2015
http://jfs.sagepub.com/content/early/2015/08/05/0734904115598163.abstract

APP as a PIN FR in thermoplastic composites

This review analyses over 170 publications researching APP (ammonium polyphosphate) as a PIN flame retardant in different thermoplastic composites, and summarising data on fire performance and on mechanical performance tests. Polymers considered include polyethylene, polypropylene (PP), polystyrene, PMMA, PET, ABS, polyamides (nylon) and poly(vinyl alcohol) (PVOH). APP shows to be an effective intumescent flame retardant, reducing peak heat release rate. It is noted that this can reduce fire temperatures in confined spaces and may so prevent 'flashover' occurring. Also, incandescent combustion is inhibited. APP is indicated to act by generating in fire both insulating carbon foam and hard, glassy char on the polymer surface, with protect from fire heat and prevent access to oxygen to feed the fire. APP also releases water and ammonia, which have a cooling effect and dilute fire gases. APP fire retardancy performance can be optimised by appropriate addition of carbon sources, which contribute to char formation and structure, for example, expandable graphite, pentaerythritol (PER). In different polymers, synergies between APP a wide range of PIN flame retardants and additives, including zinc salts, manganese salts, nickel salts, magnesium and aluminium hydroxides, phosphorus-based PIN FRs, melamine compounds, phosphonium salts and combined metal LDHs (layered double hydroxides). Impacts of APP addition on polymer mechanical properties are considered, based on the research testing publications assessed, noting that impacts can be minimised by use of pre-treated APP (e.g. intensive balling, coating, microencapsulation) or by adding coupling agents (e.g. inorganic substances such as talc, silanes).The authors note the potential of APP for PIN fire safety in rubbers and bio-based polymers, suggesting that further research and testing is needed.

"A review of application of ammonium polyphosphate as intumescent flame retardant in thermoplastic composites", K-S. Lim et al., Composites Part B, 2015, in print

http://dx.doi.org/10.1016/j.compositesb.2015.08.066

Dopamine based flame retardant tested

Researchers at the University of Texas are testing nanocoatings of polydopamine, based on the nervous system messenger molecule dopamine, as a flame retardant for polyurethane foams. The idea was inspired by marine mussels which use the compound to adhere strongly to surfaces. The foam was simply immersed in aqueous dopamine solution at pH 8.5 for 1-3 days, compressing the foam several times to ensure solution uptake into pores and with vigorous stirring, followed by rinsing in water and drying. This resulted in a 240 nm layer of polydopamine on the foam surface. This treatment reduced peak heat release rate from foam samples by up to 2/3 and prevented melt-dripping. The researchers suggest that the polydopamine acts against fire both by forming a strong char surface on the foam and by releasing the amine group which neutralises free radicals in fire gases.

"Bioinspired Catecholic Flame Retardant Nanocoating for Flexible Polyurethane Foams", J. Cho et al., Chemistry of Materials (ACS) DOI: 10.1021/acs.chemmater.5b03013
www.pubs.acs.org/cm

Other news

Reviews of flame retardant toxicology. An Elsevier journal special issue includes 12 research papers presenting animal studies and human epidemiological data concerning brominated and organophosphorus flame retardants. The introduction (Eubig et al.) underlines that flame retardant chemicals of a given class can have very different toxicological profiles. The special issue concludes with a comprehensive research review by Hendriks & Westerlink of over 250 studies of the neurotoxicity of brominated and alternative flame retardants. For brominated flame retardants (BFRs), the authors assess in vivo data for effects on human, animal and fish behaviour, synaptic plasticity, neurotransmitter systems, and in vitro data for cytotoxicity, ROS production (reactive oxygen species), Ca^{2+} homeostatis, intracellular signalling, concluding that "*the combined epidemiological and toxicological studies clearly underline the need for replacing FRs*". Non halogenated (PIN) and halogenated organophosphorus and inorganic (PIN) flame retardants are assessed, concluding that some may be "suitable substitute" FRs, others share neurotoxic effects and that for many data is currently inadequate. Amongst PIN phosphorus FRs, ALPI, BPDPP, DCP, EHDPP, IDDP, TBOEP, TEP, TIBP and TNBP are identified as potentially preferable alternatives. Some inorganic PIN FRs show neurotoxic potential in testing, but bioavailability and metabolism should be taken into account to assess possible risk. In a separate review, Fromme et al. assess c. 300 scientific papers on population exposure and risk-assessment of brominated flame retardants, concluding that population exposure to PBDEs and HBCD is considerably below levels susceptible to pose possible health risk based on toxicological data (Reference Dose Rfd), except for exposure to PBDEs in the USA. For more recent brominated flame retardants and TBBPA, the authors consider that more data on toxicology and exposure are needed for risk assessment.

ALPI = Aluminiumdiethylphosphinate, BPDPP = Resorcinol bis(diphenyl phosphate), DCP = Diphenylcresylphosphate, EHDPP = Ethylhexyldiphenylphosphate, IDDP = Isodecyl diphenyl phosphate, TBOEP = Tris(2-butoxyethyl) phosphate, TEP = Tris(ethyl) phosphate, TIBP = Tris(isobutyl) phosphate, TNBP = Tris(butyl) phosphate

"Neurotoxicity and risk assessment of brominated an alternative flame retardants", H. Hendriks & R. Westerink, Neurotoxicology and Teratology, in press 2015 *http://dx.doi.org/10.1016/j.ntt.2015.09.002*

See also Hendriks 2014 paper in pinfa Newsletter n°39

"Introduction to special issue: Neurotoxicity of brominated flame retardants and the quest for safer alternatives", P. Eubig et al., Neurotoxicology and Teratology in print 2015 *http://dx.doi.org/10.1016/j.ntt.2015.09.001*

"Brominated flame retardants–exposure and risk assessment for the general population", H. Fromme, et al., Int J Hygiene & Industrial Health, in print 2015 *http://dx.doi.org/doi:10.1016/j.ijheh.2015.08.004*

Declaration of chemicals in articles tightened. A European Court of Justice ruling has confirmed that chemicals on the "candidate list of substances of very high concern" must be indicated if present in any component of products at < 0.1% by weight (that is the 0.1% limit applies to each plastic or electronic component in a computer and not to the complete computer). ECHA will now update its Guidance documents.

European Court of Justice of 10 September 2015 in case C-106/14. ECHA statement ECHA/NA/15/32 *http://echa.europa.eu/*

US CPSC consultation on organohalogen flame retardants. The US Consumer Product Safety Commission is inviting comments on possible rulemaking on additive organohalogen flame retardants in children's toys and care articles, upholstered furniture, mattresses and electronic equipment under the Federal Hazardous Substances Act (FHSA). Deadline for comment was 19th October 2015.

http://www.regulations.gov under Docket n° CPSC-2015-0022

California report on insulation fire safety requirements. The California Office of the State Fire Marshal has published the report and recommendations following legislation AB127 on building insulation materials fire safety requirements. The report recommends to use both ASTM E119 (UL 263) and NFPA 286 (or IAC AC12 or AC377) tests for fire performance of insulation materials assemblies, running to failure not stopping after 15 minutes, to verify possible risk to firefighters in case of building fires. The working group considered exonerating from fire safety requirements construction insulation used in foundations (between earth and a concrete floor) but did not reach a conclusion because of concerns about fire risks during the manufacturing, transport, storage and installation of such materials.

"Flammability Standards for Building Insulation Materials". Working Group Report and Recommendations. CAL FIRE – Office of the State Fire Marshal. August 2015 http://osfm.fire.ca.gov

Agenda

Events with active pinfa / pinfa-na participation are marked: ►

19-20 Oct	Düsseldorf		European fire retardant coatings conference (EC European Coatings) http://www.european-coatings.com
26-30 Oct	Leeds UK		Short course: Fire Dynamics & Modelling http://www.engineering.leeds.ac.uk/short-courses/fire-engineering/fire-dynamics-and-modelling/
3-6 Nov	Scottsdale, Arizona		FCIA Firestop Industry Conference & Trade Show http://www.fcia.org/
3 Nov	Brussels	►	pinfa workshop: Ensuring the Fire Safety and Sustainability of Construction Materials - the Role of Flame Retardants www.pinfa.org
4 Nov	Brussels	►	pinfa General Assembly
4-5 Nov	Glasgow, Scotland		Fire and Materials Seminar on Bromine Flame Retardants - Life-Savers or Eco Villains? Society of Chemical Industry http://www.soci.org
14 Nov	Milan		2BFUNTEX Final Conference on Technology Transfer of Functional Textile Innovations www.2BFUNTEX.eu
30 Nov – 4 Dec	Leeds, UK		Short course: Fire Safety Design http://www.engineering.leeds.ac.uk/short-courses/fire-engineering/fire-safety-design/
8-10 Dec	Cologne, Germany		Fire Resistance in Plastics 2015 (AMI) http://www.amiplastics.com
10-12 Dec	New Delhi		IFSEC India www.ifsecindia.com
			2016
1-2 March 2016	Cologne, Germany		Sustainable Plastics 2016, from sourcing to end of life recovery (AMI) https://www.amiplastics.com
16-16 March	Mons, Belgium		1st International Conference on Eco-Friendly Flame Retardant Additives and Materials (ECOFRAM) http://www.greenwin.be/fr/event/consult/76
6-8 April	Dublin		Sustainable Fire Engineering Benchmark Event (Regional SBE16/17) http://sustainable-firengineering.ie
26-27 April 2016	Montreal, Canada	►	**pinfa-na industry seminar: flame retardancy of materials for surface transportation** http://pinfa-na.org
3-4 May 2016	Pittsburgh Pennsylvania		AMI Fire Retardants in Plastics http://www.amiplastics-na.com
11-13 May 2016	Lund, Sweden		FSF 2nd Fire Safety of Facades Int. Conference http://www.facade2016.org

15-19 May	Lisbon	47th Annual Meeting of the International Research Group on Wood Protection http://www.irg-wp.com
23-26 May 2016	Stamford CT	Recent Advances in Flame Retardancy of Polymeric Materials http://www.bccresearch.com
8-10 June 2016	Princeton, USA	SiF'16 Structures in Fire http://www.structuresinfire.com
13-16 June 2016	Las Vegas	NFPA Conference & Expo http://www.nfpa.org
4-6 July 2016	London	Interflam 2016 (14th International Conference and Exhibition on Fire Science and Engineering) www.intersciencecomms.co.uk
12-16 June 2016	Lund, Sweden	12th International Symposium on Fire Safety Science www.iafss.org
29-30 Sept 2016	London	ICFSST 2016 : 18th International Conference on Fire Safety Science and Technology https://www.waset.org
4-5 Oct 2016	Baltimore	4th International Conference on Fires in Vehicles FIVE www.firesinvehicles.com

Publisher information
This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.

For abbreviations see: http://pinfa.org

Phosphorus, Inorganic & Nitrogen Flame Retardants Association

Your newsletter for non-halogen fire safety solutions
November 2015 – No. 57

Dear Reader

Welcome to the first issue of pinfa's new improved newsletter.

In an effort to offer you the latest on fire safety, pin flame retardants, new developments, new applications, health and environment in the most efficient manner, we are very pleased to present our new electronic newsletter. It's been re-designed to be more user-friendly and make communication easier, simpler, and faster.

We hope you enjoy our first edition and would certainly welcome your feedback and comments. If you know anyone else who would be interested in hearing from us, then please forward the newsletter or the link for subscription.

Previous editions of our newsletter are stored online and content is accessible either directly or using the website search function.

We wish you an interesting reading.

The pinfa Team

3 minutes to get out

A page of videos and animation by the New York Times (sponsored by Nest Protect fire alarms) shows why fires have become so much more dangerous in modern homes. Headlines are

- *“3 minutes: the average time a family has to get out of their home”*
- *“6 minutes: the average time it takes firefighters to arrive”*
- *“Modern homes burn 8 times faster than they did 30 years ago”*
- *“Fires today burn hotter and faster. Thirty years ago, you had roughly 17 minutes to get out of your home … today that 17 minutes is down to three or four” (John Drengenberg, Consumer Safety Director Underwriters Laboratories)*
- *“It used to be that the rule was a fire in a home would double its size every two minutes. Because of the new materials, that’s a lot quicker now.”*
- *“Given that our homes are literally flammable, fire prevention and awareness have never been more important” (Lorraine Carli, vice president of outreach and advocacy at the National Fire Protection Association NFPA)*
- *“Smoke is more dangerous than ever. Modern households are filled with more synthetic materials ... so smoke is often tainted with toxins such as hydrogen cyanide, phosgene and carbon monoxide.”*

A three minute video shows how rapidly a house became a burning inferno when fire started in a space heater in a family’s home (23 Feb. 2015). The family (and dog) were saved by the sounding of smoke alarms.

Causes of faster fires are identified as increased content of synthetic materials, larger houses with open floorplans (no barriers to fire spread, faster airflow and oxygen to feed fires). A traditional and a modern upholstered chair are compared, with the former reaching peak heat release after 15 minutes, the latter after only around 4 minutes.

Barry Brinckey, Kingsport Fire Department, shows full-scale fire tests of furnished rooms using older (natural materials) and modern furnishings (synthetic materials). In the modern materials room, “*after about 30 seconds, the temperatures get higher and higher. We see lots of smoke, temperatures reach hundreds of degrees whereas in the older home room the fire is not blazing much at all.*”

An animated graph explains the different stages of development and heat release rate of a modern fire over time (ignition, growth, fully developed, flashover, decay).

UL Underwriters Laboratories “Modern residential fires: UL determined that fires today are more dangerous and pose more risks than in the past. Fire propagation is faster, and time to flashover, escape times and collapse times are all shorter …”

http://newscience.ul.com/articles/modern-residential-fires
New York Times "In a flash: how modern homes are fuelling faster fires"
http://paidpost.nytimes.com/nest/in-a-flash.html

Bus fire safety questioned in France

43 people died on 23rd October in a coach fire at Puisseguin, near Bordeaux, France, when the coach caught fire after a collision with a lorry. According to press coverage, the rapid burning of the coach prevented many passengers from escaping. Only 8 passengers managed to get out of the coach. The local head of emergency services states: "*When we arrived several minutes after the accident, everything was completely on fire… We must establish why the vehicles caught fire so fast*." Media state that black smoke and fire gave no chance to the passengers in the coach, and that the fire spread to everything, trapping passengers inside. Media also refer to previous coach fire catastrophes in France: Laffrey, Isère, Alpes, 2007, 27 deaths and Beaune, 1982, 53 dead. Media coverage underlines that "*it is not rare that tourism coaches suddenly burn, even when travelling,*" and "*It is unlikely, after such a catastrophe, that the public authorities will be able to avoid taking real measures to reduce fire risk on board coaches*." However, suitable technical solutions exist and could be mandated, for example higher flammability requirements for materials (as is already the case on trains and trams), fire detection systems and automatic extinguishing system - see FIVE 2014 (pinfa Newsletter n°47).

See The Guardian UK and The Independent

Netherlands WODC / SEO assessment

A report by SEO Economic Research for the Netherlands Research and Documentation Centre (WODC) of the Ministry of Security and Justice estimates that home fires cause over 30 fatalities per year in the Netherlands, and assesses possible regulatory safety requirements. Home sprinklers are considered not cost-effective, using currently standard technologies, but they are potentially interesting if technologies using tap water supply pressure only (no additional pumps) can be implemented. Regarding fire safety requirements for domestic furniture, the report considers that there are health concerns concerning some flame retardants used in the past (1), but that impacts are not the same for different FR chemicals. Available information concerning health and environmental impacts of flame retardants is considered incomplete. In particular, REACH does not fully address hormone disruption, biodegradability or environmental accumulation. The report therefore recommends to continue discussion of fire safety requirements for upholstered furniture, taking into account both possible impacts of flame retardants and alternative technologies. Consequently, the Netherlands Government indicated in June 2014 that it would not make obligatory home fire sprinklers or fire safety requirements in domestic furniture.

"Social cost-benefit analysis fire safety in homes", SEO Economic Research MKBA n° 2014-16, B. Hof et al. (136 pages in Dutch, inc. 4 page English summary) http://www.seo.nl/en/page/article/maatschappelijke-kosten-batenanalyse-brandveiligheid-in-woningen/

See also: "Fatale woningbranden 2008 t/m 2012", Instituut Fysieke Veiligheid, 16/7/2013 and Brandweeracademie "Jaaroverzicht fatale woningbranden 2013"

(1) Opinion Gezondheidsraad (Netherlands Health Council), 19/3/2014.

FIRA: flame retardants in furniture

FIRA, the UK Furniture Industry Research Association, has published two industry overview reports on alternative flame retardants for upholstered furniture and on the impact of FRs on the "end of life" of furniture and furnishings. The first report gives short information about the principal FRs used in furniture, their mode of action and of application to textiles (immersion, back-coating), foams and furniture. A detailed status of the regulatory status on Deca-BDE is provided, because it used to be widely applied, and the document states that most UK textile coaters have now abandoned this chemical replacing it by EBP (ethane-1,2-diyl)bis[pentabromobenzene], indicating that "this still belongs to the brominated family of chemicals and is subject to an ongoing REACH evaluation with a final decision due in 2017 / 2018. EBP has not been proposed for consideration as a POP (Persistent Organic Pollutant) at this time." This report concludes that alternative FR solutions for furniture are still not widely on the market. The second report, on FRs and furniture recycling mainly discusses the problems posed by the presence of certain legacy brominated substances used as flame retardants in end-of-life furniture, resulting from application of regulation on transboundary transport of hazardous waste and the Stockholm convention on POPs. The report concludes that there are, today, no specific regulations regarding furniture and furnishings waste management, that pressure is expected to develop, in particular if DecaBDE is added to the Stockholm Convention POP lists, and that it is in the furniture industry's interest to already investigate practical solutions to trace, monitor and manage flame retardants in end-of-life furniture, including labelling specifying FRs in new furniture placed on the market.

FIRA (UK Furniture Industry Research Association) report "Current and alternative flame retardants for upholstered furniture", September 2015, 44 pages.

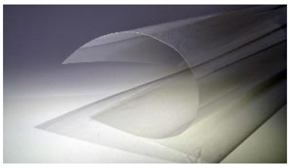
FIRA report "The potential impact of flame retardants on the "End of life" of upholstered furniture and furnishings", September 2015, 48 pages

www.fira.co.uk

Inorganic / phosphorus PIN FR synergy in HIPS

High impact polystyrene (HIPS) was tested with different combinations of two PIN flame retardants, inorganic magnesium hydrate (MH) and microencapsulated red phosphorus (MRP). Fire performance was assessed using LOI (limiting oxygen index), UL-94 (3mm thickness) and cone calorimeter (heat release rates). Highest (best) LOI and UL-94 V0 were achieved at c. 23% MH plus 10% RDP. It is noted however, that smoke and carbon monoxide release increase with MRP loadings. The authors consider that this is because this PIN FR acts principally in the gas phase by release of gaseous phosphorus compounds which interfere with combustion gases.

"Influence of microencapsulated red phosphorus on the flame retardancy of high impact polystyrene/magnesium hydroxide composite and its mode of action", J. Liu et al., Polymer Degradation and Stability 121 (2015) pages 208-221, http://dx.doi.org/10.1016/j.polymdegradstab.2015.09.011



FRX Polymers starts production in Europe

A completely new PIN flame retardant production site has opened in Europe with FRX Polymers inauguration of its new Antwerp factory, which will produce Nofia® PIN flame retardant polymers for applications including electronics, textile fiber, nonwovens, monofilaments (for synthetic hair and industrial applications), transport vehicles and performance construction materials. The Nofia® phosphorus (PIN) flame retardants are polymeric in nature and phosphorus-based, offering a favourable toxicological profile and are produced using "green chemistry" principles in that its process is solvent-free, creates no waste by products and has near 100% efficiency". FRX's Nofia® innovation and environmental progress has been recognized by awards including AlwaysOn GoingGreen Silicon Valley Global, Global Cleantech 100 list in 2012 and 2014, Green Chemistry Challenge Awards, Frost & Sullivan Product Innovation Award, Flanders Investment of the Year and the US EPA (Environmental Protection Agency) Environmental Merit Award for "making products that reduce risks to human health and reduce environmental damage …providing many industries with a safer solution for their product needs."

Photos: products using Nofia® PIN flame retardants

Press release "FRX Polymers Nofia®Flame Retardant Now Available for Worldwide Distribution, Antwerp Manufacturing Plant, Producing Nofia FR Plastic for Global Use", 21st September 2015: www.frxpolymers.com

Challenges for textile fire safety

Nicola Davies in the AATCC Review (American Association of Textile Chemists and Colorists) summarises the "vital role" played by flame retardants in ensuring textile products fire safety, but underlines that "the challenge to the textile industry is to offer reasonable protection from textile flammability, without subjecting people or the environment to further hazards from toxicity. Considerable innovation will be required to come up with solutions that all stakeholders can accept". The paper indicates a number of specific FRs for which scientists have suggested possible health issues or for which regulations to limit use are in place or are planned.

"Use and Regulation of Flame Retardants in Textiles", N. Davies, AATC Review, vol. 15, n° 6, Nov-Dec 2015, pages 34-39, www.aatcc.org

PIN fire protection for silicone rubber

First commercialised 70 years ago, silicone rubber is widely used in varying applications, because of its bio-compatibility, chemical, temperature and UV resistance and electrical properties. However, it is flammable, even if less so than organic rubber. A polymer nitrogen and phosphorus based flame retardant, cyclotriphosphazene based HPPT, was synthesised and tested in silicone rubber. This showed to generate a compact and stable char layer in case of fire, through mechanisms including melamine release and reaction with silica in the rubber. The PIN flame retardant improved fire performance characteristics measured, including LOI (limiting oxygen index) and heat release ratings (peak heat release was reduced by 40% at 18% flame retardant loading) enabling to achieve UL94-V0. Smoke emission (peak SPR) was reduced by the PIN FR by 15 – 40%. However, the HPPT did negatively affect the rubber mechanical performance (tensile strength, elongation at break).

"An efficient flame retardant for silicone rubber: Preparation and application", C. Zhu et al., Polymer Degradation and Stability 121 (2015) 42-50
http://www.sciencedirect.com/science/article/pii/S014139101530063X

Aluminium – phosphorus PIN FR for rigid polyurethane foams

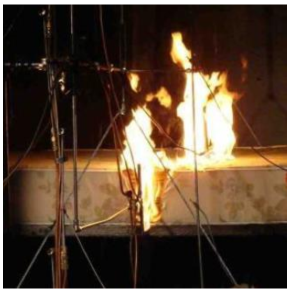
Aluminium hypophosphite and expandable graphite showed synergies as a PIN flame retardant solution for rigid polyurethane foams. Both products improved fire performance of the foam, but even better results were obtained using a combination. Total loading of 20% with a weight ratio of 3:1 expandable graphite to aluminium hypophosphite improved LOI (limiting oxygen index) fire performance rating by about 50% and reduced total heat release by a factor of about five times. Also, the two products combined had less negative impact on foam physical characteristics (cell structure, physical properties) than expandable graphite alone at the same total loading levels. Analysis suggests that the synergy effects are the result of production of a strong and compact char (with a "worm like" structure) which acts as a physical barrier on the foam surface in case of fire, preventing heat and mass transfer and so reducing combustion.

"Synergistic effect of expandable graphite and aluminum hypophosphite on flame-retardant properties of rigid polyurethane foam", W-Z. Xu et al. J. Applied Polymer Science, 42842, 2015 http://onlinelibrary.wiley.com/doi/10.1002/app.42842/abstract

Mattress fire tests

Full scale fire tests of standard bed mattresses in Korea show that heat release reaches 3 MW in less than five minutes, reaching 1000°C. The standard mattresses tested only allow 2-3 minutes for occupants to escape and the authors conclude that it is important "to prevent the ignition … or to adopt a flame retardant bed mattress." Flames reached a height of over 3m after just three minutes and by then the thick black smoke released made it impossible to see the flame. Such conditions are liable to lead to "flashover" in the room and the room untenable for occupants. Three mattresses were tested, all standard, Korean, non flame-retarded pocket-spring mattresses 1.1 x 2 x 0.28m, ignited by a small flame (ISO 12949). The authors note that 5.5% of residential fires in Korea start in the bedroom and that fires starting in other rooms can spread to bedrooms, so that the fire risks of mattresses are important.

"Flame Spread Mechanism through Analysis of Fire Behavior of Bed Mattress by the ISO 12949 Test", J. Asian Architecture and Building Engineering, K-W Park et al. Sept. 2015 http://doi.org/10.3130/jaabe.14.725



Flame retardant mattresses avoid flashover

Picture from article supporting material

Results of over 30 full-scale room fire tests in the preparatory phase of the Canada Characterization of Fires in Multi-Suite Residential Dwellings are published. The tests use a 16 m^2 test room, instrumented to measure heat release and smoke density, and cover (newly purchased, domestic) twin mattresses and beds, upholstered furniture, computer workstation, and a range of room contents (including toys, shoes, books, clothing). None of the furniture tested was indicated as containing flame retardants nor as fire safety treated (other than smouldering cigarette) and reached heat release rates (HRR) of up to nearly 3 700 kW. Most of the upholstered furniture tested (8 items: chairs, sofas, ottoman) gave heat release which would probably result in flashover after c. 2 – 4 minutes. One of seven mattresses and eight bed assemblies (bed foundation plus mattress) was classified for fire safety as open-flame resistant (16CFR1633). For both the FR mattress and bed, despite ignition and burning of the bed clothes, peak heat occurred later (after nearly ten minutes, compared to three to six minutes for non flame retarded beds) and was lower (nearly 40% lower), so that temperatures for flashover were probably not achieved. Most of the non FR mattresses and beds gave heat release rates likely to lead to flashover (HRR up to nearly 4 000 kW, room temperatures 900 to nearly 1 100 °C). Smoke density in the test with the FR mattress and bed was considerably lower than in other cases (0.4 OD_{max}/m vs. 0.9 – 2.7 for comparable non FR bed sets).

"Heat release rates of modern residential furnishings during combustion in a room calorimeter", A. Bwalya, National Research Council Canada, Fire & Materials, 39, 685-716, [DOI: 10.1002/fam.2259](DOI: 10.1002/fam.2259)

TPP in nail polish

Triphenyl phosphate (a phosphorus acid ester known as TPP or TPHP) has shown to be absorbed into the body via skin or nails when present in nail polishes. The substance is also used as a flame retardant. Concentrations of up to 1.7% by weight of TPP were found in 8 out of 10 nail polishes purchased from supermarkets and pharmacies in the USA. Volunteers painting nail polish containing around 1% TPP by weight onto their nails showed significant increases in TPP metabolites in urine, with much lower levels when the volunteers painted the product onto the outside of gloves (which were then worn or kept near hands for 1 hour). The authors conclude that TPP is absorbed into the body from nail polish principally via the dermal route (rather than inhalation) and that nail polish can be a significant exposure route for users.

"Nail polish as a source of exposure to triphenyl phosphate", E. Mendelsohn et al., Duke University, Durham, USA, Environment International 86 (2016), pages 45–51 http://dx.doi.org/10.1016/j.envint.2015.10.005

Regulatory news

EU Commission consults on chemicals for proposed specific ban in clothes and textiles: the European Commission has opened a public consultation on a proposed process for rapidly banning possibly 'CMR' chemicals (carcinogenic, mutagenic, reproduction toxic) in a wide range of articles including both raw materials (textiles, fibres, synthetic leather, artificial furs …) and finished goods: clothing, footwear, swimwear, towels, accessories, interior textiles (curtains, table cloths, floor coverings …). Real leather and furs are excluded. A first list of 291 substances to be considered is included in the consultation documents, including the following flame retardants: boron compounds, nickel compounds, TCEP, chlorinated paraffins. **Deadline for response is 22nd January 2015**.

EU consultation open to 22 January 2015 "Consultation on a possible restriction of hazardous substances (CMR 1A and 1B) in textile articles and clothing for consumer use" (published 22/10/2015) http://ec.europa.eu/growth

A report by RIVM (Netherlands, 2014), looking at 788 chemicals used in textiles, identified 32 as priorities, including the flame retardants TDCP, PrTPP (Isopropylated triphenyl phosphate), TCP, ATO (antimony trioxide), HBCD and THP urea condensate. A detailed assessment was carried out for ten of these. The report underlines that exposure information is the most important point for improving risk assessment of these chemicals, requiring data on concentrations in textiles and chemical migration out of the textile and development of an exposure model.

"Hazardous substances in textile products", RIVM Report 2014-0155, Netherlands National Institute for Public Health and the Environment (Ministry of Health, Welfare and Sport), 68 pages, in English

EU member states approve HBCD ban exemptions: the EU REACH Committee has voted to allow 13 companies to continue to use the flame retardant Hexabromocycldodecane (HBCD, banned from use in the EU since August 2014) in expanded polystyrene in building applications, subject to a number of specific risk management measures and reporting obligations. The use of HBCD is banned by the Stockholm Convention on POPs (persistent organic pollutants), with an exemption for use in buildings.

EU REACH Committee 21-22 October 2015, draft decision on HBCD.

Stockholm POPs Convention experts recommend global DecaBDE ban: the United Nations global experts of the Persistent Organic Chemicals Review Committee (PORC) have recommended the inclusion of the brominated flame retardant DecaBDE into Annex A of the Stockholm POPs Convention (Persistent Organic Pollutants). The experts recommended that governments could consider exemptions to this global ban in legacy spare parts for cars and aeroplanes, but that DecaBDE should be banned in plastics recycling. The final decision on these recommendations will be taken at the next Conference of the Parties of the Stockholm Convention in 2017. The PORC committee also decided to move the chlorinated flame retardant SCCPs (short chain chlorinated paraffins) to the next stage of the process towards Convention listing by launching a risk management evaluation.

Stockholm Convention, outcome of POPs Review Committee 19-23 October 2015 "Global chemical experts take science to action by moving towards phase out of toxic chemicals" http://chm.pops.int/

ECHA alternative flame retardant assessments: ECHA's SEAC (European Chemical Agency, Social and Economic Analysis Committee) has adopted its final opinion that restriction of DecaBDE is appropriate, with derogations for some military applications and machinery spare parts only. ECHA has also published the assessment of alternatives to DecaBDE, annexed to the REACH proposal to restrict this substance. This report considered around 200 potential substitutes, but only presents in detail 13 FRs, of which 9 are PIN FRs. This list is short, because the assessment only included products which were already considered to be marketed and in use, and for which a REACH Registration had already been made: other products which may also become available for industrial application were not considered. The report indicates that only other brominated FRs can provide a “drop in” substitute in all applications, but states that concerns about the possible identification of EBP [ethane-1-2-bis(pentabromophenyl)] as a Substance of Very High Concern may affect company substitution policy. Effective non-brominated alternative FRs can each be effectively used in certain specific applications (e.g. polymers, certain fibres …).

ECHA “SEAC concludes on Bisphenol A, DecaBDE and PFOA restrictions and finalises two opinions for authorisation”, 15th September 2015
Alternatives assessment: ECHA Committee for Risk Assessment (RAC) Committee for Socio-economic Analysis (SEAC) Background document to the Opinion on the Annex XV dossier proposing restrictions on Bis(pentabromophenyl) ether, 10 September 2015 http://echa.europa.eu/

French agency ANSES evaluates the role of FRs in furniture and fire safety

The French national agency for food, environment, work and health safety (ANSES) has published two detailed reports assessing fire safety risks and risks relating to flame retardants used in upholstered furniture. These reports conclude that the lack of adequate statistics prevents reliable assessment of how many lives or fires could be prevented in France by use of flame retardants in domestic furniture, and concludes “Given the available data on health and environment and the potential related risks, the Agency cannot recommend to generalise the use of flame retardants in domestic upholstered furniture.” Amongst other actions, the Agency suggests the establishment of a ‘positive list’ of flame retardants whose safety and effectiveness has been “demonstrated”.

Furniture fire statistics

In the first (2014) report, ANSES accepts the evidence from the UK, where furniture fire safety regulations were introduced in 1988, that deaths in fires starting in upholstered furniture fell 65% from 1985-1988 to 2002-2006, compared to a reduction of only 48% for deaths in other fires, but nonetheless suggests that it is not possible to calculate reliably how many lives are saved by the fire safety of upholstered furniture in the UK. This differs from the conclusion of the analysis carried out by Greenstreet Berman

(2009) for the UK Government, which suggests that suggesting that the Regulations account for 54 fewer deaths, 780 fewer injuries and 1065 fewer fires per year, with an economic saving of UK£ 140 million per year.

ANSES notes that in the most recent available data (2012), France's fire services attended 81 000 domestic fires and 250 000 home fires were declared to insurance companies, with 460 deaths, 1 300 serious and 13 000 light injuries. 70% of these home fires occurred during the day, but 70% of the deaths were in fires at night.

ANSES states that available fire statistics are "inadequate to conclude that fire safety treatment of upholstered furniture significantly contributes significantly to the [identified] reduction in the number and gravity of home fires." This is because fire statistics are largely inadequate, rarely reporting the cause of the fire or the items which were ignited, making it difficult to quantify the contribution of upholstered furniture to fire deaths and injuries. Also, it is difficult in fire statistics to distinguish between effects of product fire safety requirements, increasing installation of smoke alarms and decreased smoking habits. ANSES underlines that certain populations are particularly at risk of fire and recommends actions targeted at such populations, for example communication of fire safety information to children and the elderly.

Risk assessment

The second ANSES report (2015) assesses the risk of migration of flame retardants from upholstered furniture materials (ten FR-material combinations were tested for polyurethane foams, textiles, backcoatings) and assesses the possible health and environmental risks of 22 flame retardants (established and partly "legacy" FRs, see list below) identified as widely used in existing upholstered furniture. Many of these FRs are no longer used (see FIRA UK reports summarised in this pinfa Newsletter). ANSES indicates that the limitations to this study are due to difficulties in obtaining information from the French furniture industry, and the fact that the fire safety industry associations (GTFI in France) can provide only indicative information on types of FRs used, but not precise application data (pinfa note: because this data is confidential to textile, foam and furniture companies).

ANSES carried out FR migration tests on 10 FR/substrate combinations (see below) in synthetic sweat at 50°C and in air at 23°C and 60°C. These tests show that for all of these FR-material combinations, migration of the FR (including of reactive FRs tested) into simulated sweat (at 50°C) was detectable. However, into air, ANSES found no detectable FR migration for any of the tested FR-material combinations, except for migration of one flame retardant TCPP out of polyurethane foam. ANSES indicated in the stakeholder meeting of 21st October that they are aware that their migration tests only cover a small number of FRs, and that they are prepared to carry out migration tests on other FRs used in upholstered furniture, for which industry will provide treated and analysed material samples.

Assessing toxicity and ecotoxicity data availability, ANSES notes that, as required by the European Chemical Regulation REACH, toxicity data for substances registered < 1 000 tonnes/year is mostly 28 day or 90 day animal studies, and for substances > 1 000 tonnes/year chronic toxicity and carcinogenicity animal studies. ANSES identifies possible health or environmental risks indicated in literature for a number of the flame retardants considered.

Based on the migration studies for these 10 material-FR combinations and the health and environmental data available, ANSES concludes that “available data does not enable the exclusion of potential toxicity for human health or effects on the environment” for all of the 22 FRs considered to be widely used in existing upholstered furniture.

ANSES conclusions

The recommendations of the ANSES report, transmitted to the French ministry for consumer affairs (DGCCRF) are:

- **Not to generalise use of flame retardants in upholstered furniture**
- Systematic **collection of information about fire causes** in order to identify risk situations, including from insurance company statistics
- Regular **maintenance of “autonomous” (battery) smoke alarms**, installation of which is obligatory in all French homes since March 2015.*
- Installation of **residential fire extinguishers**
- Regular **verification of electrical and gas installations** in housing
- Fire prevention information and escape **training of populations potentially vulnerable to fire risk**, including via fire services, public authorities, insurance companies
- **Public communication campaigns** about domestic fire risks, and evaluation of their results
- Develop an **inventory of materials containing flame retardants**, concentrations of FRs in different materials, in particular those imported into the EU
- **Improvement of knowledge concerning the health and environmental effects of flame retardants**
- Develop **methods for measuring flame retardant emissions** from upholstered materials in real use conditions, including adaptation of these methods to take into account material ageing
- **Life cycle analysis studies** of upholstered furniture to address losses of FRs into the environment and improve protection of workers in recycling activities

- Develop **furniture fire tests** which are realistic as regards conditions for fires starting and developing in homes. This requires better knowledge of real fire situations
- Envisage the establishment of a **"positive list" of flame retardants whose non-toxicity and whose effectiveness in real applications has been established**

** pinfa editors note: battery powered, non mains connected ("autonomous") smoke alarms, as required in France, are illegal for sale in the UK, because it is known that batteries are very often removed or not replaced when empty. Also in France, there is no obligation to verify that smoke alarms are installed or operative, for example when renting or selling accommodation.*

pinfa response: proposals to move forward

pinfa welcomes the ANSES assessment as a significant step towards improving home fire safety in France.

The report indicates concerns about possible health and environmental risks posed by certain flame retardants used in the past. pinfa addresses the concerns of fire safety, environment and human health and commitment to collaboration as communicated by pinfa's mission statement. Accordingly pinfa is open to a constructive dialogue with ANSES.

ANSES, Agence Nationale de la Sécurité Sanitaire, Alimentation, Environnement, Travail (French national agency for food, environment, work and health safety) www.anses.fr
ANSES press release summarising reports' conclusions, 22/10/2015, in French: "Pour prévenir le risque d'incendie domestique en France, privilégier des mesures alternatives au traitement des meubles rembourrés par des retardateurs

Annex: ANSES lists of flame retardants and materials tested

The FR-material combinations tested for FR migration (from ANSES report II table 12 page 45/243)

Foam	– Polyurethane foam + TCPP – Polyurethane foam + TDCPP – Polyurethane foam + TPP
Induction	– Cotton - PVC with ATO and phosphorus FR – Cotton - PVC with phosphorus FR – Jersey PA - PVC with ATO and phosphorus FR – PET – PU with ATO and brominated FR

Backcoating	– Back coating leather polyester DBDPE and ATO
Reactive FRs	– Cotton, cotton/polyester with THCP (Proban) – Cotton with DMPPA – Cotton with phosphonic acid / (Bis) guanidinium phosphate
Additive FRs	– Polyamide fibres with melamine polyphosphate – Polypropylene fibres with DBDPE and ATO – Polyester with RDP

The 22 FRs for which health and environment data is assessed:

Halogenated FRs and their synergists

1. DBDPE Decabromodiphenylethane, CAS 84852-53-9
2. DecaBDE Decabromodiphenylether, CAS 1163-19-5
3. HBCD Hexabromocyclododecane, CAS 25637-99-4
4. TBPH Bis(2-ethylhexyl) tetrabromophtalate, CAS 26040-51-7
5. TDCPP Tris(2-chloro-1-chloromethyl) phosphate, CAS 13674-87-8
6. TCPP Tris (1,3-dichloro-2-propyl) phosphate, CAS 13674-84-5
7. Antimony trioxide, CAS 1309-64-4
8. V6 2,2-bis(chloromethyl)trimethylene bis(bis(2-chloroethyl)phosphate), CAS 38051-10-4
9. Zirconium potassium hexafluoride, CAS 16923-95-8

PIN FRs

10. Phosphoric acid, CAS 7664-38-2
11. Phosphonic acid, CAS 6303-21-5
12. BPADP / BAPP Bisphenol A Bis-(diphenyl phosphate) CAS 181028-79-5 or 5945-33-5
13. IPTPP Tri(isopropylphenyl)phosphate, CAS 68937-41-7 or 26967-76-0
14. Melamine, CAS 108-78-1
15. Melamine phosphate, CAS 20208-95-1
16. (Bis) guanidinium phosphate, CAS 5423-23-4
17. RDP Resorcinol Bis-diphenylphosphate, CAS 57583-54-7
18. DMPPA Dimethylphosphono-N-hydroxymethyl-3-propionamide, CAS 20120-33-6
19. TCP Tricresyl phosphate, CAS 1330-78-5
20. THCP Tetrakis (hydroxymethyl) phosphonium chloride, CAS124-64-1
21. TPP Triphenyl phosphate, CAS 115-86-6
22. Zirconium acetate, CAS 7585-20-8

Data were also collected for 6 other FRs which were not in fact assessed, because considered to be not widely used in upholstered furniture.

1. TBBPA Tetrabromobisphenol A, CAS 79-94-7
2. TCEP Tris (2-chloroethyl) phosphate, CAS 51805-45-9
3. Phosphonic acid copolymer, no CAS number
4. TEHP Tri ethyl hexyl phosphate, CAS 78-42-2
5. TOCP Tri-o-cresyl phosphate, CAS 78-30-8
6. TBEP Tris(2-butoxyethyl) phosphate, CAS 78-51-3

Agenda

30 Nov – 4 Dec	Leeds, UK	Short course: Fire Safety Design http://www.engineering.leeds.ac.uk
8-10 Dec	Cologne, Germany	Fire Resistance in Plastics 2015 (AMI) http://www.amiplastics.com

10-12 Dec	New Delhi	IFSEC India www.ifsecindia.com
		2016
26-28 Jan	Coral Springs Florida	Thermoplastics Concentrates 2016 (AMI) http://www.amiplastics.com
1-2 March 2016	Cologne, Germany	Sustainable Plastics 2016, from sourcing to end of life recovery (AMI) https://www.amiplastics.com
16-17 March	Mons, Belgium	1st International Conference on Eco-Friendly Flame Retardant Additives and Materials (ECOFRAM) http://www.greenwin.be
6-8 April	Dublin	Sustainable Fire Engineering Benchmark Event (Regional SBE16/17) http://sustainable-firengineering.ie
26-27 April 2016	Montreal, Canada ►	**pinfa-na industry seminar: flame retardancy of materials for surface transportation** http://pinfa-na.org
3-4 May 2016	Pittsburgh Pennsylvania	AMI Fire Retardants in Plastics http://www.amiplastics-na.com
11-13 May 2016	Lund, Sweden	FSF 2nd Fire Safety of Facades Int. Conference http://www.facade2016.org
15-19 May	Lisbon	47th Annual Meeting of the International Research Group on Wood Protection http://www.irg-wp.com
23-26 May 2016	Stamford CT	Recent Advances in Flame Retardancy of Polymeric Materials http://www.bccresearch.com
8-10 June 2016	Princeton, USA	SiF'16 Structures in Fire http://www.structuresinfire.com
13-16 June 2016	Las Vegas	NFPA Conference & Expo http://www.nfpa.org
4-6 July 2016	London	Interflam 2016 (14th International Conference and Exhibition on Fire Science and Engineering) www.intersciencecomms.co.uk
12-16 June 2016	Lund, Sweden	12th International Symposium on Fire Safety Science www.iafss.org
29-30 Sept 2016	London	ICFSST 2016 : 18th International Conference on Fire Safety Science and Technology https://www.waset.org
4-5 Oct 2016	Baltimore	4th International Conference on Fires in Vehicles FIVE www.firesinvehicles.com

Publisher information
This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.

For abbreviations see: http://pinfa.org

Your newsletter for non-halogen fire safety solutions
December 2015 – No. 58

Analysing firefighter exposure to smoke

Fabian, Baxter & Dalton's 27 page paper "Characterization of firefighter smoke exposure" summarises ongoing work to better understand how and to what extent smoke exposure can pose health risks for firefighters, and how to reduce these risks. The key toxic gases in smoke (HCN, NH_3, SO_2, NO_2, H_2S and CO) are principally an immediate danger to life, but without significant long-term effects. Smoke particles, on the other hand can carry significant amounts of toxicants including antimony, arsenic, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, strontium, phthalate esters and polycyclic aromatic hydrocarbons. Some long-term toxic substances can be found in both gases and particles: benzene, hydrocarbons, formaldehyde. Also, exposure to particles themselves, in particular ultrafine particles (<1µm), is known to correlate to cardiovascular disease and lung diseases. The paper suggests that firefighters could be better protected from smoke exposure. For example, protective equipment is often not worn in many situations such as the 'overhaul' phase after the peak fire intervention, or during response to outside fires such as vehicles, garages, gardens and wildlands. A previous detailed report by the same authors (Underwriters Laboratories, 2010, 390 pages), analysed smoke from three different scales of fire: residential structure and vehicle fires (firefighter equipment monitoring), simulated real-scale fires, small scale materials fire tests. The principle conclusion was that smoke characteristics varied very widely depending on the size of fire, the type of materials burning and the ventilation conditions and that different materials released different toxicants in smoke. This report noted that >99% of smoke particles collected during 'overhaul' were <1µm and that >97% of these were too small to be visible by the naked eye so that polluted air does not look smoky. Carcinogenic chemicals identified in smoke included benzene, styrene, chromium, formaldehyde and polycyclic aromatic hydrocarbons. Previous studies have also recognised fire soot to be carcinogenic (e.g. studies on chimney sweeps, since Pott over 200 years ago) in particular the IARC monograph 2010. This is generally attributed principally to PAHs (poly aromatic hydrocarbons, e.g. Baxter, in Patty's Toxicology, 6th Edition, 2012)

"Characterization of Firefighter Smoke Exposure", T. Fabian J. Borgerson, P. Gandhi, Underwriters Laboratories USA, C. Baxter, C. Ross, J. Lockey, University of Cincinnati College of Medicine, J. Dalton, Chicago Fire Department, Fire Technology 50, 993-1019, 2014

"Firefighter exposure to smoke particulates", Underwriters Laboratories Northbrook Division, Final Report, 08CA31673 - IN 15941, April 1, 2010

IARC Monographs on the evaluation of carcinogenic risks to humans, volume 98 (2010) "Painting, firefighting and shiftwork" and IARC

PIN flame retardants effective in polystyrene

A combination of PIN flame retardants was tested in extruded polystyrene (100 x 100 x 3 mm sheets), showing to be effective in ensuring self-extinguishment (combustion stops when flame heat source is removed), preventing ignition and reducing heat release. Peak heat release was reduced by around half, from 870 to 430 W/g. The PIN flame retardant tested was a combination of ammonium polyphosphate (APP), melamine and a carbon source (pentaerythritol), dosed at 0 – 30 % by weight in the polystyrene. Smoke hazard was also considerably reduced by the PIN FR, with carbon monoxide content cut to around 1/3 compared to unprotected polymer (from 0.14 to 0.05 %).

"Experimental study on polystyrene with intumescent flame retardants from different scale experiments", Z. Wu et al., Fire and Materials, 2014 DOI: 10.1002/fam.2251

Fire testing of flat panel TVs

Six models of flat-panel 32-40 inch TVs (3 samples of each one) were fire tested to assess ignition resistance, heat release, smoke and toxic gas emissions. 3 x 3 TVs were purchased in South America (SA: Brazil and Mexico) and were considered to not contain flame retardants (FRs). 3 x 3 were purchased in the USA and two of these three models were UL94-V1 fire rated. The flame retarded TVs could not be ignited by a small flame (50W, 60 seconds) and were also self-extinguishing – except that fire developed in the manufacturer supplied stand/bracket (these were not fire rated). The study recommends that manufacturers ensure that stands/brackets respect the same fire safety standards as TV screen units. The FR TVs sold in the USA mostly showed higher brominated dioxin/furan emissions in fire, confirming that brominated flame retardants were used. The FR TVs gave the lowest carbon monoxide emissions (the key toxic gas posing immediate danger in fires), except in one test where the front of the screen was involved in the fire. Maximum smoke emissions were highly variable with no pattern differentiating FR from non-FR TVs. Smoke emissions appeared to depend more on which elements of the TV casing / screen / stand were involved in fire than on presence or not of flame retardants. The FR TVs all showed lower peak heat release.

"Combustion Characteristics of Flat Panel Televisions With and Without Fire Retardants in the Casing", M. Blais & K. Carpenter, Fire Technology, 51, 19-40, 2015, DOI: 10.1007/s10694-014-0420-7 Work funded by North American Fire Retardant Association and American Chemistry Council.

Non-FR polystyrene blamed for nightclub tragedy

Sixty people were killed by fire in the Collectiv nightclub, Bucharest, 30th October, including the bassist of the band on stage Goodbye to Gravity. The band's pyrotechnics ignited non fire safety treated polystyrene acoustic insulation material and the fire spread fast, with most victims being killed by toxic smoke. It is reported that the pyrotechnics were not adapted to indoor use. The club opened in 2013 in a former factory. Fire services arrived 11 minutes after the first alarm call. Tens of thousands of protesters in Bucharest and other Romanian cities have demanded the resignation of government and criticised local politicians for giving the club operating authorisation.

A similar incident involving non flame retardant insulation foam killed 100 people in the Station Nightclub, Rhode Island, USA, in 2003.

Wikipedia list of nightclub fires https://en.wikipedia.org/wiki/List_of_nightclub_fires

BBC 7/11/2015 "Romania nightclub fire: Death toll rises to 41"

Fire safety theme park

A new "fire safety theme park" in Tianjin, North-East China, allows visitors to experience the difficulties of evacuating from fire with limited visibility, here with a maze filled with orange smoke. The park also presents the history of fire services, information on the dangers of fire and advice on how to act in case of fire. Visitors can also play at being firemen with real firefighters' equipment and water hoses.

BBC News 10th November 2015

PIN flame retardants market growth

Global flame retardant markets are expected to continue to grow over coming years according to several recent studies, with particular development in several specialised PIN flame retardant sectors. Low smoke non-halogen polypropylene is expected to show strong growth, nearly doubling in tonnage 2013 – 2020, according to Persistence Market Research, driven by construction and electrical and electronics (E&E). Another study looks at development of the PIN FR PBT (polybutylene terephthalate) global market and in China. A Statistics MRC study of world flame retardant markets predicts a doubling in sales values from 6 to 14 billion US$ 2014-2022 (11% annual growth rate CAGR), driven by current and new applications, technology developments and emerging economies, particularly in automobile and construction applications.

Persistence Market Research "global low smoke halogen free flame retardant polypropylene (PP) market"

"Global And China Halogen Free Flame Retardant PBT Industry 2014 Market Research Report"

Statistics MRC "Global Flame Retardant Chemicals Market Outlook (2014-2022)"

Life cycle assessment of FRs in electronics

As a part of the EU-funded ENFIRO project (see pinfa Newsletter n°36), a life cycle assessment of use of flame retardants in electronics was carried out. The summary conclusions have now been peer-reviewed and published. Five PIN FRs and three brominated FRs were assessed, as used in five different polymers in laptop computer components, taking into account the full cradle-to-grave cycle of the laptop, including production, computer use, accidental fires and waste disposal. The largest differences in impact were identified in the study "in the waste phase, due to an increased dioxin emission formed out of brominated FRs during improper waste treatment". The study also identifies, in the assessed conditions, a higher impact from the studied brominated FRs during accidental fires "due to a higher rate of smoke formation and a higher terrestrial ecotoxicity". These results illustrates the need for a proper waste treatment of WEEE materials.

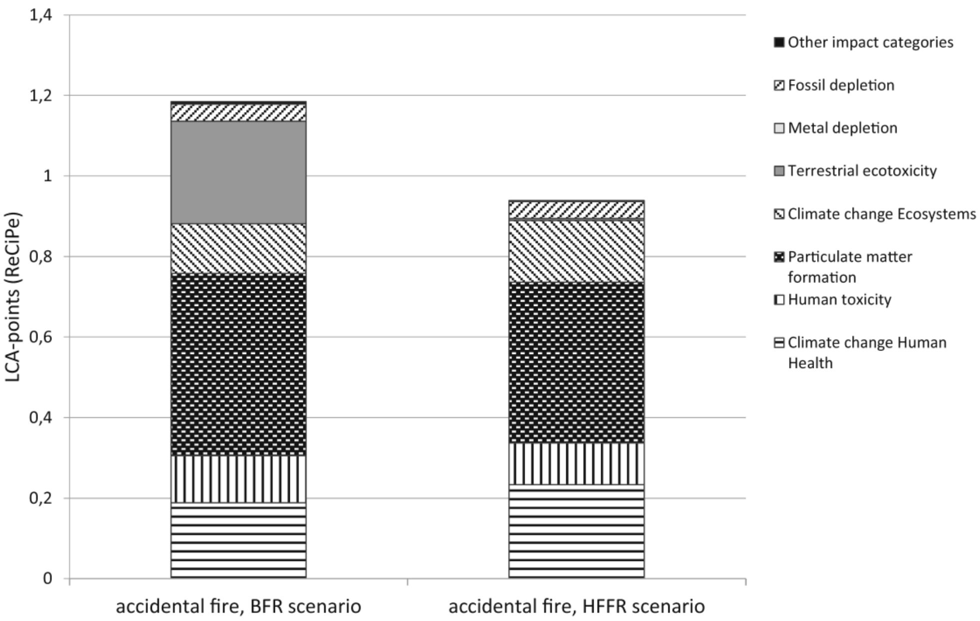


Figure: Environmental impact for accidental combustion of a laptop with brominated or PIN flame retardants. Note the risk of fire occurring is not taken into account here and no comparison is made to a laptop without flame retardants.

PIN FRs studied: Aluminium diethylphosphinate (Alpi) + melamine polyphosphate (MPP), 9,10Dihydro -9 -oxa -10 -phosphaphenanthrene (DOPO), Zinc hydroxystannate (ZHS) coated aluminium hydroxide (ATH), Resorcinol bis(diphenyl phosphate) (RDP), Bisphenol A bis(diphenylphosphate) (BDP). Brominated flame retardants studied: DecaBDE, TBBPA, Brominated polystyrene.

"Life cycle assessment of flame retardants in an electronics application", International Journal of Life Cycle Assessment (Springer), N. Jonkers et al., 2015 http://dx.doi.org/10.1007%2Fs11367-015-0999-z

ENFIRO (Life Cycle Assessment of Environment-Compatible Flame Retardants) www.enfiro.eu

New silicon based PIN FRs for greener plastics

The final report has been published for the EU-funded (FP7) project FR GREENSI (New silicon-based halogen-free flame retardants for greener plastics). The project developed silicone derived FRs for polycarbonate and polyamide polymers which are widely used in many applications including medical equipment, electrical and electronic, transport, mechanical and industrial components … PIN FRs for polycarbonate, based on a vinyl silane combined with a phosphorus functionality, were developed to achieve EN45545 railway fire performance standards including smoke density (VO4 to ISO-5659-2), and were tested by a major global polycarbonate producer. For polyamide (PA), UL94 V1 and V0 requirements were achieved (30% glass fibre reinforced PA) with a combination of a silane (silicon based), talc, zinc borate and melamine cyanurate (nitrogen based PIN FR).

Source: http://cordis.europa.eu/result/report/rcn/57283_en.html

High flexibility PIN flame retardant ducting

Industrial dust-extraction ducting specialist, Eximo Australia, has launched speedLock CNCFlex PIN flame retardant polyether-polyethylene ducting. This is for dust and particle suction in woodworking industries and other material milling and cutting processes (CNC = computer numerical control of machining) and designed for internal pressure – vacuum resistance. The transparent material offers very high flexibility, resistance up to 100°C and resistance to hydrolysis, abrasion, oil and chemicals. PIN flame retardants enable conformity to DIN 4102-B1 fire standards whilst ensuring technical and mechanical performance. The ducting is available in 82 – 508 mm diameter and in 10m rolls or cut to length.

"Ducting solutions for CNC machining": http://www.eximo.com.au/

UNEP Energy Globe Award for PIN flame retardants

Interiorproject Ltd has been awarded the Bulgarian national Energy Globe Award for its PIN flame retardants for porous polymers. The Energy Globe Awards www.energyglobe.info are a World Environment Day initiative led by UNEP and UNESCO, which rewards outstanding sustainable and environmental best practice. The Interiorproject PIN flame retardants combine phosphorus (phosphoric acid), nitrogen (urea, triethanolamine, ammonia) and mineral (silicon containing polydimethylsiloxane). They can be used, by brush, rolling or dipping, on porous materials including wood fibre based materials (such as paper and cardboard), leather, cellular or foamed polystyrene, polyurethane, etc. The Energy Globe Award website indicates that the PIN FRs help to protect polymers used in modern interiors from fire, stating that they are "halogen-free, non toxic, biodegradable and recyclable … sustainable products." Specific formulations for different polymers enable self-extinguishing and low smoke. Fire and technical performance test results are presented in the published patent.

"Halogen-free flame retardant impregnation of porous polymers. National Energy Globe Award Bulgaria 2014" http://www.energyglobe.info/bulgaria2014?cl=english

Interiorproject Ltd http://www.interiorprotect.com/en/

US Patent n° 8,815,113 https://www.google.be/patents/US8815113

Presafer new applications for Preniphor^{TM}

Presafer has extended its Preniphor^{TM} PIN flame retardant range with performance products for polypropylene and for epoxy resins. Preniphor^{TM} EPFR-100D is a P-N (phosphorus and nitrogen) based flame retardant for polypropylene. The product is designed to provide an acid source, a gas source and a carbon source, so ensuring effective intumescent (surface charring) fire protection, enabling polypropylene to achieve UL94 V-0 (0.75 mm), GWIT 3mm 750°C and GWFI 3 mm 960°C fire performance. The product also ensures low smoke density, water resistance and low density, reduced mold corrosion and polypropylene material quality (tensile, elongation, flexural and impact strength). Its high decomposition temperature offers processing advantages and ensures low foaming in extruders. Preniphor^{TM} EPFR-APP224 and Preniphor^{TM} EPFR-APP262 are the P-N based flame retardant for intumescent coating, textile coating and epoxy resin, offering stable viscosity, excellent weatherability and glossy finish, as well as low water solubility and low migration. Fire performance of UL94 V-0, NF P 93 501, DIN 4120, DIN5510, EN 13501-1-B, FMVSS 302 and BS 5852, can be achieved, as well as low corrosivity, low toxicity smoke emission, low viscosity, good dispersity and particle size distribution ensure processing compatibility.

100D - http://www.presafer.com/ppenviromentalflameretardant

APP224 - http://www.presafer.com/appflameretardant

APP262 - http://www.presafer.com/flameretardantforcoating

Fate of phosphorus FRs in sewage works

The fate of ten phosphorus ester flame retardants (aryls and alkyls) in activated sludge and advanced oxidation process sewage works was assessed in five sewage works in Spain. Concentrations detected in sewage works inflow ranged from 4 to 150 parts per billion (total of the ten FRs). These results shows that concentration remains at extremely low level. The chlorinated alkyl FRs (TCEP, TCIPP, TDCPP) were not removed by standard sewage treatment (activated sludge) whereas the aryl FRs (TMPP, EHDP, TEHP and TPHP) were mainly transferred to sewage sludge and were not detectable in the plant discharges. Advanced treatment (ultraviolet/H_2O_2 peroxide or ozone) proved to be effective in breaking down the non-chlorinated P-FRs detected in wastewater effluent (TNBP, TIBP, TBOEP) but not the chlorinated alkyls.

"Can activated sludge treatments and advanced oxidation processes remove organophosphorus flame retardants?" J. Cristale et al., Environmental Research 144 (2016) 11-18

Prysmian PIN FP Cables for Art's sake

Over 5 km of Prysmian FP Plus PIN fire resistant cables have been installed in Edinburgh College of Art as part of a fire safety upgrade of two of the Edinburgh University's Lauriston Campus buildings, including complete replacement of the fire alarm and installation of a voice evacuation system. The University's consulting engineer considers that FP PLUS is the highest performing fire resistant cable on the market. The FP PLUS cables use a PIN flame retardant "low-smoke zero-halogen" outer sheath, offering robust performance and flexibility. Contractor JG Mackintosh indicates that these characteristics make the Prysmian PIN FP cables easy to work and adaptable to the irregular shape of the Art College buildings. FP PLUS cables conform to BS5839 and BS5266-1 and are approved by BASEC and LPCB for fire safety applications.

IFP Magazine 10/2015 "For Art's sake, it's got to be Prysmian"
http://uk.prysmiangroup.com/

Brewers corn bio-based PIN FR composite

A bio-composite was developed by combining poly lactic acid (PLA, a bio-sourced polymer from crop starches or sugars), processed distillers dried grains with solubles (DDGS) and the biodegradable, polymeric PIN flame retardant RDP resorcinol di(phenyl phosphate). DDGS is the non-fermentable, cereal coproduct of corn brewing, of which 20 million tonnes/year are produced in China alone. It was smashed and water-washed, then compounded with RDP and PLA. Loadings of 15% RDP and 15% DDGS achieved good mechanical properties and fire performance (increased limiting oxygen index, decreased peak heat release rate, self-extinguishing, no burning drip and achievement of UL-94 V-0. The DDGS is identified as contributing to char generation, increasing the flame retardancy effect of RDP.

"Flame-retarded biocomposites of poly(lactic acid), distiller's dried grains with solubles and resorcinol di(phenyl phosphate)", Y. Ju et al., Composites Part A 81 (2016) 52-60.

Regulatory news

Consultation: ECHA (the European Chemical Agency) has opened a public consultation **to 18th February 2016** on proposals to subject 11 additional chemicals to REACH "Authorisation". This effectively bans sale or use of the chemical after a given date, except for possible specific authorisations. The 11 chemicals are a phthalate, two boron compounds, two hydrophthalic anhydrides, lead compounds and trixylyl phosphate (an organophosphate ester used in lubricants, hydraulic fluids and as a flame retardant in plastics).

"ECHA consults on 11 substances to be proposed for authorisation", ECHA/PR/15/15, 18th November 2015 http://echa.europa.eu/

Arc fault circuit breakers: Fire fighters and burn victims have successfully opposed a proposal in Alabama to remove from home building codes the requirement for Arc Fault Circuit Interrupters. These are devices which respond to electrical failures beyond the functional level of standard circuit breakers, which can prevent fire causing electrical incidents. Similarly in North Carolina, discussions are underway to prevent adoption of the 2014 National Electrical Code ® NEC® which extends application of arc fault circuit interrupters into kitchens and laundry areas. The installation cost of this fire and electrical protection is estimated at US$300 per home.

"Safe Home Alabama" (NFPA70) NFPA Journal November/December 2015

Agenda

26-28 Jan	Coral Springs Florida	Thermoplastics Concentrates 2016 (AMI) http://www.amiplastics.com
1-3 Feb	Barcelona	COST MP1105 Training School "Strategies to study fire behaviours and fire retardant mechanisms" COST.MP1105@UGent.be
15-16 Feb	Torino	COST MP1105 MP1105 Final Conference on "Fire retardants & textiles: past, present and future" COST.MP1105@UGent.be
1-2 March	Cologne, Germany	Sustainable Plastics 2016, from sourcing to end of life recovery (AMI) https://www.amiplastics.com
1-3 March	Cologne, Germany	AMI Cables 2016 https://www.amiplastics.com
16 March	Istanbul	Pinfa Building and Construction fire safety workshop
16-17 March	Mons, Belgium	1st International Conference on Eco-Friendly Flame Retardant Additives and Materials (ECOFRAM) http://www.greenwin.be
6-8 April	Dublin	Sustainable Fire Engineering Benchmark Event (Regional SBE16/17) http://sustainable-firengineering.ie
14-15 April	Aalborg, Denmark	COFISH16 Conference on Fire Safety & Health http://www.cofish16.aau.dk/
26-27 April	Montreal, Canada ►	**pinfa-na industry seminar: flame retardancy of materials for surface transportation** http://pinfa-na.org
3-4 May	Pittsburgh Pennsylvania	AMI Fire Retardants in Plastics http://www.amiplastics-na.com
11-13 May	Lund, Sweden	FSF 2nd Fire Safety of Facades Int. Conference http://www.facade2016.org
15-19 May	Lisbon	47th Annual Meeting of the International Research Group on Wood Protection http://www.irg-wp.com
23-26 May	Stamford CT	Recent Advances in Flame Retardancy of Polymeric Materials http://www.bccresearch.com
8-10 June	Princeton, USA	SiF'16 Structures in Fire http://www.structuresinfire.com
12-16 June	Lund, Sweden	12th International Symposium on Fire Safety Science www.iafss.org
13-16 June	Las Vegas	NFPA Conference & Expo http://www.nfpa.org
21-22 June	Philadelphia	AMI Polymers in Cables 2016 http://www.amiplastics-na.com
4-6 July	London	Interflam 2016 (14th International Conference and Exhibition on Fire Science and Engineering) www.intersciencecomms.co.uk

21-26 August	Philadelphia	ACS Fire and Polymers VII www.acs.org or alexander.morgan@udri.udayton.edu
29-30 Sept	London	ICFSST 2016, 18th International Conference on Fire Safety Science and Technology https://www.waset.org
4-6 Oct	Baltimore	4th International Conference on Fires in Vehicles FIVE www.firesinvehicles.com
6-8 Dec	Cologne, Germany	AMI 11th Fire Resistance in Plastics https://www.amiplastics.com

Publisher information
This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.

For abbreviations see: www.pinfa.org

Phosphorus, Inorganic & Nitrogen Flame Retardants Association

Your newsletter for non-halogen fire safety solutions
January 2016 – No. 59

pinfa workshop on construction materials: sustainable fire safety challenges

The **industry – expert B&C workshop organised by pinfa**, Brussels, 3rd November 2015, brought together 60 specialists and industry leaders from Europe, Asia and North America, to discuss questions around sustainable fire safety of materials used in modern buildings: fire risk data and fire statistics, fire testing and what this really tells us, different approaches to fire safety in buildings, how to combine green building objectives with fire safety.

Upcoming workshops

- *Pinfa Building and Construction fire safety workshop, Turkey, date to be defined*
- *pinfa-na industry seminar: "Flame retardancy of materials for surface transportation"*
  26-27 April 2016, Montreal, Canada *http://pinfa-na.org*

Past workshops

- *pinfa North America workshop on "Flammability Requirements in Construction", Tampa, 15-16 April 2015, in pinfa Newsletter n°55*
- *pinfa North America workshop on fire safety in E&E (electrical and electronics equipment), California, 4 April 2013, in pinfa Newsletter n°29*
- *pinfa workshop Brussels, 24 June 2010 ""Building the future for flame retardants in E&E"*
  http://pinfa.org/documents/Media/News/pinFa_WKS_Executive_Summary_News_20100908.pdf
- *pinfa E&E workshop, Taipei, 8 November 2011, in pinfa Newsletter n°12*

Responsible approach to flame retardant use

Michael Klimes, pinfa President (Nabaltec), opened the meeting with the challenges faced by the fire safety sector today. The green awakening which started with Rachel Carson's "Silent Spring" in the 1960's fundamentally changed the perception of the chemical industry. pinfa recognises the need for responsible chemistry, addressing the effects of chemicals, in order to provide important functions to society with optimal substance environmental and health profiles. Today, there is public debate as to whether flame retardants are useful and whether they are really needed. This was started by concerns about possible health impacts of certain classes of chemicals, but has become in the media an indiscriminate generalisation that all flame retardants are dangerous. But what would our world look like without flame retardants? How could safety of public transport or electrical goods be ensured? All those who are concerned by fire safety need to respond to this.

pinfa recognises that flame retardants are one tool amongst a range of other important actions for fire safety, e.g. public education into how to react to fire, building design, smoke alarms, use of inherently non-flammable materials. This workshop, as well as providing an update of relevant knowledge and application, should provide input to proposals as to where flame retardant use is necessary to complement these actions and where they may be not appropriate.

Fires are fast and deadly

Anja Hofmann, BAM Germany, summarised lessons from full-scale fire tests and fire modelling. Full-scale building fire tests were carried out in 2014 by BAM with the **Fire Services of Frankfurt** (TIBRO project), using five rooms in a building destined for demolition. The objective was to see how rapidly conditions become lethal in a fire in a furnished room and smoke toxicity developed in a room adjacent to the fire.

Tests (funded by EFRA) showed how fast fire becomes lethal in a modern home. Flashover occurred just 4 minutes after ignition (by a candle flame) in a furnished children's bedroom: that is the transition from a developing fire to a fully developed fire where all contents are involved in the fire. Maximum temperatures had reached 400 °C near the floor (50 cm) and 1 000 °C near the ceiling. Flashover occurred after around 9 minutes in a small room containing just one upholstered chair in another test.

Photo: Berlin Fire Service

The fire tests in Frankfurt showed that fires developed significantly faster in the room with the modern furniture compared to a room with 1980's furniture. In these room tests, smoke toxicity became lethal in an adjacent room after 7 – 9 minutes.

Anja Hofmann also discussed fire safety of ETICs (External Thermal Insulation Cladding panels) with polystyrene foam insulation. Energy saving objectives for buildings, particularly in renovation, is leading to widespread installation of such panels. Fire performance of these systems depends highly on the size and energy of the ignition source and the placement of the ignition source, i.e. inside or outside the building. This can be seen in real fires as well as in large and intermediate scale tests. Several full scale fire tests and numerical modelling of these fires have shown that modern room fires can result in significantly higher heat flux to the wall above an opening than is considered in the German proposed DIN test for facade systems..

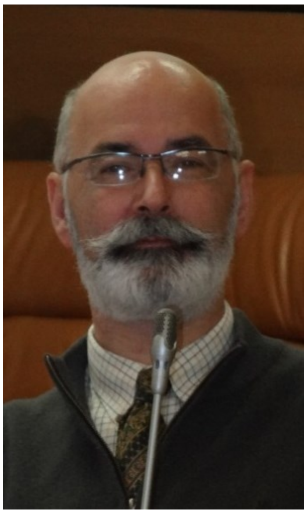
Smoke fatalities and smoke toxicity

James Robinson, Fire Safe Europe, underlined that fire kills 12 people every day in the EU, and costs 126 billion €/year. An important problem is the lack of adequate fire statistics in nearly all countries. What fire data does exist is not comparable, and so nearly impossible to use to identify best practices or to define fire safety strategy actions. This should be addressed by ISO/TR 17755 (Fire Safety) and this work should be supported and pushed forward.

The Construction Products Regulation (CPR, EC/305/2011) does however represent a significant step forward in building fire safety in Europe, by ensuring harmonised building product fire safety performance standards and tests, including concerning smoke density. Some aspects however need further specification, for example the CPR does not define tests for ETICs (see above).

Mr.Robinson underlined the importance of smoke emission is in fire safety, indicating two very different issues. On the one hand, over half of fire deaths are due to smoke. Incapacitating gases in smoke can prevent escape for occupants. However, if occupants do escape, then they generally have no long term effects from smoke. On the other hand, firefighters are repeatedly exposed to smoke and soot, which contain a number of potentially carcinogenic substances. This may contribute to the proven increased risk of cancer and shortened life expectancy for fire fighters.

Polymers and fibres, in a wide range of products from computers to natural fibres, decompose in fire. Some flame retardants which reduce heat release rates or inhibit reactions in fire gases can lead to an increase in carbon monoxide production in fires and increase smoke hazard to occupants (incomplete combustion products). ISO 13571 can estimate the impact of fire on evacuation time based on the concentrations of the most relevant hazardous components (like smoke, CO and HCN and irritant and/or incapacitating gases). It is suggested to integrate such an approach into the Construction Products Regulation. Some molecules act to reduce heat release but at the expense of increased smoke potency. This can be avoided by using an appropriate material + flame retardant combination designed to provide the required end product performance.



Need for reliable fire statistics

Dominique Parisse, Plastics Europe (and previously with the French State fire and safety services), further developed the current inadequacies of fire statistics in Europe. ISO 17755-2, under development, is important to address this. This is a slow process, because it is necessary to start by agreeing terminology: in some countries, fire victims who die in hospital a few days after the fire are not counted as fire deaths.

ISO/TR 1775:2014 "Fire safety - Overview of national fire statistics practices" is available for 165€ at https://www.evs.ee/products/iso-tr-17755-2014

Different levels of report may be available after fires: firefighters onsite report, fire service specialist fire investigator's report, external fire investigators (e.g. police, insurance), forensic. Both training and human resources are necessary to enable fire services to generate useable data on causes of fires, given the emotional and operational difficulties whenever a fire casualty is incurred. But in practice, mostly only the fire fighters' reports are available, if that.

Despite unreliability of data, it is clear that fire deaths are falling in most countries worldwide, for example -17% in 19 EU states (for which data is available) over the period 2006 – 2010, but also that numbers of fires and deaths are very variable between different EU states. The limited statistics available show that both arson and smokers materials are significant causes of fire fatalities.

In **discussion**, participants also underlined the importance of space heaters in causing fires in winter in some countries, and also increasing use and fire risk from candles.

Stephen Grayson, Interscience London, underlined that the bigger the fire, the more smoke is generated so that statistics indicating that 70% of fire deaths result from smoke confirm that the key to reducing fire risk is to prevent and slow fire development.

Oliver Loebel, PU Europe, explained that fires in buildings are changing, with more goods, electronic equipment and comfort materials, and more complex buildings, both for offices and public buildings but also for homes, which are getting bigger (m^2/habitant, with a tendency towards open geometries). Time to fire flashover so becomes shorter. This is accentuated by trends to improve insulation, so enclosing heat in case of fire, with airtight envelopes and controlled ventilation systems. Despite this, there is a clear downwards trend in the number of fire deaths in almost all EU countries. This proves that fire regulations are effective.

Polyurethanes are increasingly used to ensure thermal insulation, for example in building insulation panels or in district heating piping. A recent study concluded "*The current and correct application (of combustible insulation) in the building envelope does neither significantly contribute to the severity of the fire nor to an increase in victims*".

EFECTIS Netherlands for the Dutch government (VROM), 2009 "'Brandveiligheid van Isolatiematerialien" https://zoek.officielebekendmakingen.nl/blg-73603.pdf

Mr Loebel emphasised that building fire safety is very complex, necessitating a holistic approach, taking into account design and compartmenting, content, escape routes, construction materials and insulation, active fire protection, training and organisation. Performance-based building codes appear as the best way forward to address fire safety in complex buildings, with the Construction Products Regulation providing important foundation with European tests and standards which can be implemented in national building regulations.

Building fire safety challenges

Hans Beele, Beele Engineering (passive fire safety specialists), questioned the difference between what fire safety regulations require on paper and reality in installations, due to the gap between construction and certification. This is particularly critical for cables which can pass from one room to another, crossing fire barriers, and which can make up a significant fire load if disused cables are not removed as new ones are added when electrical and communications systems are modified. Materials are fire safety certified, but generally not seals around penetrations through barriers and into voids, yet these must stop not only fire but also moisture and chemicals.

Flame retardants are required at high loadings in cables, and this impacts material properties. Particular attention must be paid to durability over real life times, often 20 years or more, and to possible deterioration resulting from repeated changes in temperature. Beele Engineering therefore has developed in-house compounding to provide flame retardant – polymer packages for specific engineering applications. Smoke emission and corrosivity are key issues, and PIN flame retardants can address these. Beele Engineering has launched its own Sealing Valley Campus with NOBO, bringing together, R&D, pilot test facilities and installer training.

Health and environment

Frank Kuebart, eco-INSTITUT Germany, presented a comparison of criteria concerning flame retardants in 65 ecolabels and sustainability standards worldwide. Key health and environment criteria for flame retardants are:

- Low toxicity, not irritant
- Avoid migration from products into indoor air (lower molecular weight FRs are detected at low levels in indoor air, notably TCPP which has a relatively high vapour pressure)
- Not persistent or bioaccumulative
- Limit soot and smoke toxins susceptible to pose health risks particularly for fire professionals
- End-of-life and recycling

Consequently, in addition to general exclusion of chemicals with problematic properties (CMR, PBT, vPvT …), a number of different labels exclude halogenated or brominated flame retardants (Blue Angel, LEED (US Green Building Council), TCO.

Positive list approach

Dr Kuebart noted that both TCO and LEED are moving towards a positive list approach, in addition to excluding certain types of chemicals (e.g. halogenated). These positive lists are based on simplified assessment tools such as Green Screen (*see pinfa Newsletter n°41*), the Healthy Building Network Pharos Project, or HPDs Collaborative (Health Product Declaration).

The continuing development of PIN flame retardants which offer improved health and environment profiles and can achieve these positive lists will open new markets for passive fire safety.

Two eco-labels (Eco-INSTITUT and Natureplus) also exclude all organophosphorus FRs. This shows the need to open dialogue with NGOS and scientists to define positive safety and acceptability criteria for PIN FRs, in particular for organophosphorus FRs which have very varied and different properties. This dialogue should also address the safety of PIN FRs in recycling.

Stuart Harrad, University of Birmingham UK presented concerns about population exposure to flame retardants. Past-generation halogenated flame retardants (e.g. PBDEs, HBCD) have been found in human blood and breast milk. In take is thought to be mainly via ingestion of dust and in food, but cosmetic industry models suggest also dermal uptake.

The INFLAME project shows that flame retardants may come out of products by migration to air, abrasion of particles or fibres or transfer from the product into dust particles which settle on it. Levels of emission depend very strongly on use conditions of products. Because of progressive phase-out of some brominated flame retardants, concentrations of phosphorus FRs (both halogenated and non-halogenated) are now higher, and further work is needed to assess the possible risks posed and measures to reduce this.

Marianne Cochez, Université de Lorraine, France and **José-Marie Lopez Cuesta, Ecole des Mines d'Alès**, France, presented a range of developments in PIN flame retardant technologies. Technologies offering potential include nano-forms of flame retardants (which can both improve performance for the same flame retardant loading and also offer new functionalities, but raise questions about possible migration of nano-materials into the environment), nano-clays, graphene, bio-based or bio-derived flame retardants (e.g. metallic phytates, phloroglucinol, lignin derivatives), and a wide range of new phosphorus-based PIN flame retardants.

Important challenges for PIN flame retardant development include continuing to improve environmental profiles, polymer product and processing performance and compatibility with bio-sourced materials and composites, and ensuring that new FRs maintain fire safety performance with ageing. In all cases, the production complexity and so cost is a key criteria, and new substances proposed by researchers must offer realistic feasibility for scale-up to industrial production.

Conclusions: need for action

Adrian Beard, pinfa Vice-President (Clariant), summarised the workshop discussions. Further research and action is needed in the following areas:

- Need for better fire statistics, both to have reliable and comparable data on fire fatalities, injuries and costs, and to identify the causes of fires and actions which can reduce causalities
- Assess the respective roles of flame retardants and other passive and active fire protection measures
- Improve understanding of the health and environmental impacts of flame retardants, in particular concerning the indoor environment (air and dust)
- Innovation in PIN flame retardants, to continue to improve the current industry portfolio of products, including health and environment profile, cost, functionalities
- In particular, further develop PIN flame retardant solutions for bio-based materials, produce bio-based PIN flame retardants
- Ensure that PIN flame retardants are compatible with materials recycling

pinfa is committed to contribute to move these objectives forward, both within the PIN flame retardant and user industries, and in dialogue with stakeholders and regulators.

Summary of pinfa-NA workshop on "Flammability Requirements in Construction", April 2015, see pinfa Newsletter n° 55
Summary of pinfa-NA workshop on "Fire safety for aviation", April 2013, see pinfa Newsletter n° 40
Summary of pinfa workshop on "Building the future for flame retardants in E&E", June 2010, see pinfa Newsletter n° 4
Photos of workshop: www.burning-questions.eu/2015-11_pinfa_BC

Agenda

26-27 April	Montreal, Canada	►	pinfa-na industry seminar: flame retardancy of materials for surface transportation http://pinfa-na.org
15 June	Brussels	►	pinfa General Assembly www.pinfa.org

***Full up-to-date conference and events listing** – see www.pinfa.org*

Publisher information

This Newsletter is published for the interest of user industries, stakeholders and the public by pinfa (Phosphorus Inorganic and Nitrogen Flame Retardants Association), a sector group of Cefic (European Chemical Industry federation). The content is accurate to the best of our knowledge, but is provided for information only and constitutes neither a technical recommendation nor an official position of pinfa, Cefic or pinfa member companies.

For abbreviations see: www.pinfa.org