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FIRE SAFETY AND COVID



pinfa vision for tomorrow

Despite the current challenges, there seem to be opportunities for fire safety with safety awareness, home working, growth of IT and reshoring of plastics supply chains. pinfa members and the pinfa Advisory Board in May separately and informally discussed challenges and opportunities for fire safety and flame retardants of the Covid crisis. The pinfa Advisory Board brings together scientists, stakeholders and experts. The economic downturn will put pressure on fire safety, but Covid has increased overall safety awareness. The recovery plan will emphasise environmental concerns, favourable to PIN flame retardants. Distance working is pushing growth in communications technologies, where flame retardants are essential to ensure fire safety, and will increase domestic fire risk (time spent and equipment for home working). Perceptions of plastics have become more positive, seen as key for protective and medical equipment. Changes in plastics and IT supply chains could offer opportunities for production chains in Europe, requiring EU expertise and supply of fire safety materials. For pinfa itself, the new acceptance of distance conferences enables to reach new audiences and communicate more actively.

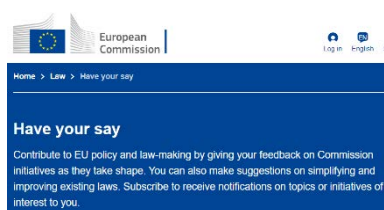


Euralarm calls for safety in EU recovery plan

The EU's recovery plan building "renovation wave" should include the update of fire safety and security installations. The fire safety and alarm industry federation EURALARM sees building renovation as an opportunity and driver for tighter fire safety requirements, necessary as the fire load in buildings increases and the number of electric and electronic devices increases. EURALARM also underlines the challenges posed by the increase in home working, for both fire and cyber- security.

"Ambitious EU Recovery Plan needed for a safer and more secure society", EURALARM, 25th May 2020 <https://www.euralarm.org/hotel-travel/dossier/spotlight>

CONSULTATIONS OPEN



EU public consultation on CPR

A public consultation is **open to 19th August** on revision of the **EU Construction Products Regulation**. The proposed 'Roadmap' underlines the Green Deal and Circular Economy Action Plan objectives of making buildings more sustainable and facilitating repair, re-use and recycling, and indicates a wide range of other objectives for the revision, including reducing compliance costs, coherence with other EU legislation, improving legal clarity, transparency and data, adaptation to innovation and safety. pinfa will input to support the environmental objectives proposed and underline the importance of fire safety.

EU consultation on CPR, to 19th August 2020:
<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12458-Review-of-the-Construction-Products-Regulation>



EU 'Renovation Wave' public consultation

A public consultation is **open to 9th July** on the EU Green Deal building energy efficiency initiative "Renovation Wave". The public questionnaire proposes "fires and earthquakes" as one the six objectives for building renovation in its first question, but not as an option under "regulatory policies" (Q3.3). pinfa will submit a short input emphasising the need to combine highly effective insulation for energy efficiency with sustainable fire safety.

EU consultation "Energy Efficiency in Buildings – consultation on 'renovation wave' initiative" <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12376-Commission-Communication-Renovation-wave-initiative-for-the-building-sector> Note : the web page includes a closed roadmap consultation, scroll down for the open public consultation

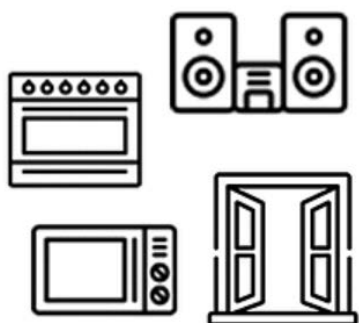


GPP consultation computers - smartphones

Update to EU Green Public Purchasing proposes to exclude halogenated FRs and promote alternatives assessments. An EU (JRC) stakeholder [consultation](#) is **open* to 17th July 2020**. The proposal includes a new “core and comprehensive” criterion restricting halogenated substances in plastic parts: to limit both bromine and chlorine (each separately) to < 1 000 ppm in plastic parts of > 25g (5g for smartphones), with exceptions for PCBs (printed circuit boards and PVC cables). This criterion is already in TCO Certified Generation 8, EPEAT 2018 for computers and Blue Angel UZ-78 v2. Also, a new incitement is proposed to “Avoidance of regrettable substitution”, with points awarded if “safer alternatives are used for ... halogenated flame retardants. (and) proposed alternatives have been assessed by methods and tools as indicated by the European Chemicals Agency or the OECD Substitution and Alternatives Assessment [Toolbox](#)”.

“Revision of the EU Green Public Procurement (GPP) Criteria for Computers and Monitors (and extension to Smartphones)”, European Commission JRC Technical Report v2.0, June 2020
<https://susproc.jrc.ec.europa.eu/computers/stakeholders.html>

* this consultation is only open stakeholders registered on JRC BATIS, although the above document is public. Please send comments, to pinfa.



EU to identify product groups for Ecodesign

The European Commission has launched a study and consultation to identify product groups for new Ecodesign criteria. The study will run to December 2020. A stakeholder webinar is [set](#) (**10th July AM, register by 6th July**) and first draft reports are [published](#) for comment. Objectives are to integrate Ecodesign and Energy Labelling, to target circular economy potential, to cover complex products (several products combined in one), “horizontal initiatives” and products not consuming energy but influencing energy consumption (window systems are proposed, but not insulation or other construction materials). Via Ecodesign criteria, the EU has banned all brominated flame retardants in TV and monitor enclosures from 2021 (see pinfa Newsletter n° 108), however the draft documents published to date for this new study do not consider flame retardant or halogenated content limitations. You can register on the study [website](#) to receive further information and invitations to stakeholder meetings and to participate in a **first webinar on 10th July 2020**.

Study for the European Commission to prepare the Ecodesign and Energy Labelling Working Plan 2020-2024, Viegand Maagøe, VHK & Oeko-Institut <https://www.ecodesignworkingplan20-24.eu/>

First stakeholder webinar, 10th July AM: register here before 6th July
<https://www.ecodesignworkingplan20-24.eu/meetings>

Draft documents [published](#) and open for stakeholder input: Tasks 2 and 3 = identification and analysis of product groups and horizontal measures
<https://www.ecodesignworkingplan20-24.eu/documents>



New RoHS exclusions of halogenated FRs?

Progress towards RoHS restrictions on further halogenated FRs (MCCPs, TBBPA) and antimony (ATO) in electrical and electronic equipment (E&E). Following the public consultation in January 2020 (see pinfa Newsletter n°110), ÖkoInstitut presented proposed [conclusions](#) at a [webinar](#) 27th April 2020. RoHS restrictions are recommended for MCCPs (Medium Chain Chlorinated Paraffins) and TBBPA (tetrabromobisphenol A) used in additive form. The UK Environment Agency has completed the REACH CoRAP evaluation of MCCPs, concluding that they are PBT and vPvB and should be candidate for SVHC (substance of very high concern). Conclusions for ATO (antimony trioxide) are that it should be assessed as a “functional group” with halogenated FRs because “mono-substitution (substituting only ATO as synergist) in products on the market does not seem to be applied”. Other flame retardants included in ÖkoInstitut’s [full list of substances](#) for possible consideration for RoHS restriction, but not taken further, are Trixylyl phosphate, TCEP, TCPP, TDCP, boric acid.

ÖkoInstitut RoHS evaluations page “Interim Results of Substance Review” <https://rohs.exemptions.oeko.info/index.php>



Study on Ecodesign of smart phones

The EU is inviting input to a preparatory study, to run to February 2021, on Ecodesign of mobile phones, tablets and cordless landlines. The study, led by Fraunhofer IZM, will also cover energy efficiency and material efficiency. **A first stakeholder meeting is announced for 13th July 2020.**

Ecodesign preparatory study on mobile phones, smartphones and tablets <https://www.ecosmartphones.info/> Register [here](#) to receive information

REGULATORY



中华人民共和国工业和信息化部
Ministry of Industry and Information Technology of the People's Republic of China

New electrical vehicle standards in China

China has passed new mandatory safety standards, including fire safety, for electric vehicles, EV batteries and electric buses. The new standards enter into force on 1st January 2021. Battery tests will address thermal runaway, water ingress, impacts and external fire resistance. Electric bus safety requirements will include fire resistance specifications for high voltage components.

“China announces new EV safety standards” 14th May 2020
<https://www.electrive.com/2020/05/14/china-announces-new-ev-safety-standards/> and in Chinese
<http://www.miit.gov.cn/n1146290/n1146402/n1146440/c7909341/content.html> and http://autonews.gasgoo.com/new_energy/70017149.html



Canada adopts tent flammability standard

CAN/CGSB-182.1-2020 fixes flammability and labelling requirements for tents, including flammability tests when new, after leaching, after weathering. The [new standard](#) requires resistance to a horizontal fire test (comparable to ASTM D2859) for flooring materials and a vertical small burner test. Applicable to consumer tents for outdoor, or outdoor and indoor use, including camping, child and trailer tents, tepees, dining and sun shelters, etc., as well as separate components and accessories to the tents. The standard is likely to be also adopted in the US, where a final adoption ballot is underway under ASTM F3431 F08.22 (Standard Specification for Flammability of Materials for Recreational Camping Tents and Warning Labels for Associated Hazards)

http://publications.gc.ca/collections/collection_2020/ongc-cgsb/P29-182-001-2020-eng.pdf CAN/CGSB-182.1-2020



Photo :
Vincente Mans for Budenheim.

Wildfires in Horizon 2020

Wildfires are proposed as one of the priorities in a call for Horizon Europe, R&D to support the Green Deal. The European Commission consulted on actions in eleven areas in May, with wildfires as one of three proposed calls under the theme of Climate Change. The EU is looking to fund innovative and integrated approaches to preventing, predicting and fighting wildfires, including R&D into wildfire behaviour, data and monitoring, wildfire fighting technologies and equipment, governance, including awareness and preparedness, restoration and adaptation.

Documents https://ec.europa.eu/info/research-and-innovation/strategy/european-green-deal/call_en



Raising the Alarm: the Case for Better Flame Retardant Regulation in Canada

An ELC Clinic report prepared for:
Local 730, Victoria Fire Fighters Association
Law Student: Harleen Randhawa
Articled Students: Carlin Stockwell, Ruben Tillman
Supervising Lawyer: Calvin Sandborn, QC

May 2020



Canada firefighters call to ban halogen FRs

Victoria Fire Fighters Association calls for a ban* on organohalogenated flame retardants in furniture, mattresses, children's products and electronics casings. The report submitted to the Canada federal regulators by the University of Victoria (UVic) for the fire fighters' association also says other (non-halogenated) FRs, in these products, must demonstrate** safety to health, necessity of use and no safer alternative. The report says that *"additive, non-polymeric, organohalogen flame retardants are the most concerning class of flame retardants"* and that halogenated FRs *"pose elevated health risks upon combustion – a problem that poses a particular health risk for fire fighters who are exposed to the toxins that are released from combustion"*.

* similar to legislation in California, Maine and Rhode Island. ** similar to legislation in California, Oregon and Minnesota. "Common fire retardants killing firefighters, UVic report", Vancouver Sun [15th May 2020](#) and report "Raising the alarm: the case for better flame retardant regulation in Canada", University of Victoria Environmental Law Centre, May 2020 <http://www.elc.uvic.ca/raising-the-alarm/>

Fire Technology
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on behalf of the Fire Retardant Association



A Critical Appraisal of the UK's Regulatory Regime for Combustible Façades

Judith Schulz and Darren Kent, Arup, 13 Finsbury Street, London W1T 4BQ, UK

Tony Crimi, A.C. Consulting Solution Inc., 1960 Yonge St., Box 30613, Richmond Hill, ON L4C 4H0, Canada

Jim L. D. Glocking, Fire Protection Association, London Road, Moreton in Marsh, Gloucestershire GL56 6RH, UK

T. Richard Hall, Centre for Fire and Hazard Science, University of Central Lancashire, Preston PR1 2HE, UK

Received: 17 August 2019/Accepted: 3 May 2020

Abstract. The Grenfell Tower fire has brought the regulatory system that permitted combustible materials on high-rise buildings in England into question. At the heart of that system is the BS 8414 test, and the BS 125 criteria used to demonstrate compliance with the Building Regulations. The test is empirical and the criteria arbitrary; there is no scientific link between test performance and how a building will perform in the event of a fire, nor any detailed analysis of why fires spread through façade systems which have passed the test. Following the Grenfell tragedy, the UK government commissioned a series of tests on Grenfell Tower-type facades, using BS 8414. This paper critically analyses BS 8414, the BS 125 criteria used for assessment, and

UK façade cladding regulations questioned

UK fire experts say rules do not account for real risks of fire penetrating the building and do not ensure safety. The analysis of the current UK regulations for combustible cladding materials, by experts from the UK Fire Protection Association, Arup and UCL (University of Central Lancashire) says that the UK's cladding fire test BS 8414 does not take account of real risks of fire penetration through windows, uses non representative cavities behind the cladding, has an imprecise and manipulatable fire source, and allows conditions which do not ensure safety (the temperature can reach 600°C in 15 minutes and a cladding system will still pass). Following the Grenfell fire in 2017, which killed 72 people, 454 buildings > 18 m in the UK were identified as having similar highly combustible aluminium composite material (ACM) cladding, of which only 114 have to date completed renovation work. Many more buildings have other types of combustible cladding, for example high-pressure laminate (HPL wood fibre – resin boards) similar to Lakanal House (where [six people died in fire in 2009](#) following a fire starting in a TV and spreading through the non fire-rated external cladding). The authors suggest changes to the UK cladding fire test (fuel source, test rig), investigation of coherence between test results and real building fires, revised regulatory criteria and public access to information on test results.

"A Critical Appraisal of the UK's Regulatory Regime for Combustible Façades", J. Schulz et al., Fire Technology, 2020
<https://doi.org/10.1007/s10694-020-00993-z>



Finalisation of the European approach to assess the fire performance of facades

The project is formed in accordance with the Invitation to Tender for "Finalisation of the European approach to assess the fire performance of facades" (Call for tenders No 761/PP/2020/264/19/1033/11462) of the European Commission (September 2019). The objective of the project is to finalise the methodology to assess the fire performance of facades including test methods and a proposal on classification.

Developing new EU façade fire test

Ri.Se leads EU-funded project to finalise new approach to fire testing of building cladding systems, rainscreens, ETICs and wooden façades. A consortium with Ri.Se, Efectis, BAM, EMI and Uni Liège won the EU tender and the project will run for two years to March 2022. Stakeholder participation is invited to provide cladding system samples and/or to input on systems to be tested and review and comment results as the project develops. The objective is to finalise the fire test methodology outlined already in the report "Development of a European approach to assess the fire performance of façade" ([published](#) by the EU in 2018), see pinfa Newsletter n°95, and to propose classifications for adoption as CEN harmonised standards, for European Assessment Documents (EOTA) and for the Construction Products Regulation.

"Finalisation of the European approach to assess the fire performance of facades" website <https://www.ri.se/en/what-we-do/projects/finalisation-european-approach-assess-fire-performance-facades> including introductory webinar and invitation to participate for stakeholders.



INNOVATION



Fire safety shapes cable industry future

Compounding World (AMI industry magazine) underlines fire performance and material flexibility as key wire & cable industry developments. Cable polymer compounds expect ongoing growth at 4% per year, especially in Extra High Voltage cables, submarine cables (for offshore renewable energy) and fibre optic network cables, with an ongoing move away from PVC to Low Smoke Zero Halogen / Low Smoke Flame Retardant (LS0H LSFR), both in Europe and in Asia, if less so in North America. Revision of the EU Construction Products Regulation is expected to lead to demand to new formulations with higher LOI (limiting oxygen index). Industry developments include innovation in cross-linking of cable compounds, to combine fire performance, cable flexibility and heat resistance and new compounding processes, such as underwater compounders, to improve component reactions and final product purity. Perspectives from leading companies in extrusion, compounding, cables and cable compound or component suppliers are cited: Buss, Borealis, Borouge, Hexpol, Lubrizol, TeknorApex, Padanaplast, BASF and Magnafin. All of these companies offer non-halogenated (PIN) flame retardant cable solutions.

"Fire and flexibility top cable industry developments", M. Holmes, Compounding World (AMI), May 2020 www.compoundingworld.com



Polypro PIN FR masterbatch for fibres

Dynamic Modifiers launches non-halogenated, non-antimony polypropylene concentrate for polyolefin textiles, films and molded parts. The concentrate conserves lightweight advantages of polyolefin fibres and non-polar properties, which tend to limit bacteria or virus attachment or growth, and is compatible with transparency, colours and printable with corona or plasma surface treatment. UL94-V2 fire performance is achieved (0.8 mm), using 8% to 14% let down of polypropylene homopolymer based concentrate. Low smoke and self-extinguishing behaviour is achieved in FAR 25.853a 12 second and 60 second vertical burn test used for aerospace applications. The concentrate is non-toxic, uses PIN flame retardants not risking migration, and can bring LEED points for green construction.

"Non-Halogen, Low-Smoke: PAL...NH-LS Performance FR Passes NFPA-701 Test", Dynamic Modifiers, 8th April 2020

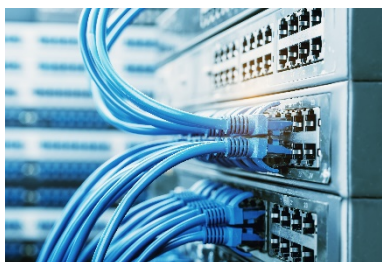
<https://www.textileworld.com/textile-world/fiber-world/2020/04/non-halogen-low-smoke-pal-nh-ls-performance-frtm-passes-nfpa-701-test/>



New clear PIN FR polyester film

DuPont Teijin Films new non-halogen flame retardant PET polyester films offer cost-effective VTM-0 fire safety, durability, chemical and water resistance. The films are ANSI / UL94 "halogen-free" and achieve the best class of UL VTM (Vertical Thin Material) flame rating VTM-0. Films have approximately 1% haze and are available from 75 to 175 µm thickness in roll widths up to 1.6m and more. FR films can help product designers achieve improved safety in the industrial, transportation, construction, electronics and label industries. Other applications of the FR PET material include laminate structures, battery labels, insulating materials, lighting and flexible printed circuitry.

"DuPont Teijin Films Introduces Flame Retardant Clear Polyester Film. Melinex® FR320/FR321 PET Films UL Certified as VTM-0", 29 April 2020 <https://europe.dupontteijinfilms.com/news/2020/dupont-teijin-films-introduces-flame-retardant-clear-polyester-film/>



LSZH cables safer for data centres

Tests show that low smoke zero halogen cables achieve fire performance with much lower smoke emission and corrosivity. Six power and data cables were tested, for fire performance to NFPA 262, FM 3972 or UL 1685 FT4. The flame retardant or low smoke cables passed fire tests and showed smoke yield (g/g) an order of magnitude lower than the two other cables. The LSZH cables showed corrosivity* over 70x lower than the tested halogen-containing cable. The authors conclude that the LSZH cables tested show good fire and smoke corrosion performance.

* corrosivity measured as mm/year = mpy. "Evaluation of flammability and smoke corrosivity of data/power cables used in data centers", D. Zeng et al., Fire Safety Journal 2020 <https://doi.org/10.1016/j.firesaf.2020.103094>



Safety orange for e-vehicle components

Domo Chemicals has launched performance polyamides for high stability orange-colour connectors, plugs, housings and insulators. Specific orange RAL 2003 (Europe) or RAL 2008/2011 (North America) is required to warn of high voltage components in electric vehicles. The performance Technyl PIN flame retardant polyamide compounds, previously Solvay and now with Domo Chemicals, offer high colour stability at elevated temperatures, low mould deposits in processing, CTI (comparative tracking index) ≥ 600 and UL94-V0 (0.4 mm).

"Technyl Orange: Domo's high-performance polyamide for EV parts and components", 17 December 2019 <https://www.technyl.com/safety-orange-new-range-of-polyamide-for-safer-electric-vehicles/>



PIN FR epoxy meets motorsport requirements

A new PIN FR epoxy resin prepreg meets demands of Formula One, NASCAR and other motorsports, with fire performance SFI 56.1 and UL94-V0. Toray Advanced Compounds new TC346 resin system is a high-temperature resistant, lightweight non-halogenated epoxy offering toughness, tensile, compression, and interlaminar shear strength and in-plane shear modulus (tested up to 180°C) in a wide range of uni-directional fabrics and tapes. Surface finish properties offer aesthetic quality. SFI 56.1 fire performance is achieved at 1 ply thickness and UL94-V0 at 2 mm (both with 200g 2x2 Twill HM63 12K 42% resin Content).

"Toray's High-temperature Epoxy Resin for Automotive Receives FR Certifications", 3 June 2020 [SpecialChem](https://www.specialchem.com/news/2020/06/03/toray-high-temperature-epoxy-resin-for-automotive-receives-fr-certifications/) and <https://www.toraytac.com/product-explorer/products/Nn1i/TC346>



Resisting fire and water

New cable system offers PIN fire safety, with low smoke, low toxic gas emission, and protects against water ingress in weathering or flooding. Flexicon Ultra connectors use non-halogenated flame retardants to achieve fire safety meeting railway standards (NFPA 130 and IRIS). They offer mechanical strength and performance, including 70 kg pull-off resistance and a one million cycle service test (equivalent to 35 years in transport operation). Protection from water of cables and electronics to which they are connected is essential for safety, to prevent failures, ensure electrical safety and enable continuing systems functioning in case of incidents, and these connection sealings are water ingress protection tested to IP66 - IP69.

"Prevent Costly Wiring Failures with AFC Cable Systems Flexicon Ultra, 1st May 2020 <https://www.utilityproducts.com/tools-supplies/article/14175196/prevent-costly-wiring-failures-with-afc-cable-systems-flexicon-ultra> and <https://www.afcweb.com/flexicon/>



New low-fogging PIN FR

Daihachi Chemicals has launched a new phosphorus-based FR for applications including automotive, polyesters, leather and PUR foam. The product is also effective for polyolefins, in particular polypropylene. It has low hot water solubility (0.3 @90°C, pH 4.2 – 8.9), low fogging and high heat resistance. It is not Classified under GHS labelling and can offer a preferred substitution for halogenated FRs such as TDCP in polyurethane foam. FMVSS302 burn length < 20 mm is achieved for resin/FR coated polyester fabric or < 10 mm for leather.

https://www.daihachi-chem.co.jp/eng/technology/flame_retardant.html



Bio-based resin prepreg offers rail innovations

Composites Evolution has developed a bio-based resin prepreg (PFC502) which meets the most stringent fire hazard requirement (H3) of the EU railway standard EN45545-2. The resin is based on polyfurfuryl alcohol, derived from agricultural waste biomass. It is thermosetting, and offers lower toxicity and lower VOC emissions than phenolic resins, as well as temperature and chemical resistance, and can be processed by vacuum bagging, press moulding or autoclave. It is flame retarded using non-halogenated (PIN) flame retardants. Both glass- and carbon-fibre reinforced resin laminates were tested to ISO 5660-1, EN 5658-2 lateral flame spread and EN ISO 5659-2 smoke density and toxicity. A rail carriage door leaf using the prepreg and developed by TRB Lightweight Structures has won the Composites Industry UK [Environmental / Sustainability Award](#) 2018. Carbon fibre reinforced bio-resin facings are used with a recycled polymer foam core, achieving a more than one third weight saving compared to an aluminium train door (enabling energy savings and faster door closing), at comparable cost. Composites Evolution is a UK-based developer, manufacturer and supplier of prepreps and natural fibre reinforcements for lightweight composite structures

"Award-winning train door features Composites Evolution's bio-resin prepreg", 1/4/2019 <https://compositesevolution.com/news/award-winning-train-door-features-composites-evolutions-bio-resin-prepreg/> and "Bioresin prepreg meets the most stringent HL3 requirements of rail fire standard EN45545-2", 5/2/2019 <https://compositesevolution.com/news/bioresin-prepreg-meets-the-most-stringent-hl3-requirements-of-rail-fire-standard-en45545-2/>

RESEARCH



FRs can prevent smouldering from becoming fire

Tests of different furniture textile / batting / foam combinations show that flame retardants can prevent smouldering developing to flaming fire. The materials were mounted as in upholstered furniture with cotton, polyester, blend or FR blend fabric, cotton or polyester batting and three different polyurethane foams (non-FR, FR to FMVSS 302 = automotive standard and FR to BS5852 = UK furniture standard). They were subject to an 11 W heater, equivalent to a smouldering cigarette. Samples with BS5852 foam or with FR textile did not develop to flaming fire. Samples with polyester textile and polyester batting did not catch fire because of melt-back, whereas samples with non-FR textile and non-FR or automotive standard foam showed transition to flaming fire. The

authors conclude that appropriately flame retarded fabrics or foam prevent the transition from smouldering to flaming fire.

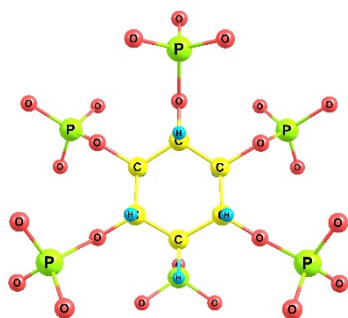
“Studying smoldering to flaming transition in polyurethane furniture subassemblies: Effects of fabrics, flame retardants, and material type”, A. Morgan et al., work funded by North American Flame Retardant Alliance, Fire and Materials. 2020;1–12, <https://doi.org/10.1002/fam.2847>

Fire safety and mechanical performance



Innovation project combines surface modifications with PIN FRs to improve mechanical performance of composites. The ZIM FlamZation project will develop synergies between PIN surface treatments and fillers to achieve fire safety of composites (combination of polymers and fillers) with high mechanical performance, e.g. for E&E and technical applications. The project is funded by the German government and is carried out by DTNW (Deutsches Textilforschungszentrum Nord-West GmbH) and KIMW (Gemeinnützige Kunststoffinstitut für die Mittelständische Wirtschaft Forschungs-GmbH) with the downstream industrial companies abcr GmbH, ENTEX Rust & Mitschke GmbH, Bada AG and Weidmüller Interface GmbH & Co. KG (electronic components, extrusion, special chemicals, testing).

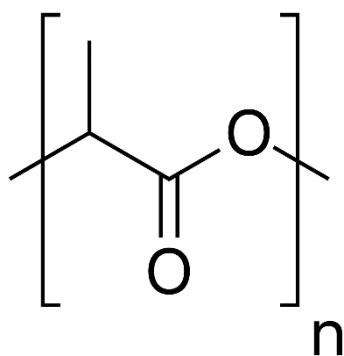
ZIM (Zentrales Innovationsprogramm Mittelstand) FlamZation
<http://www.dtnw.de/forschungsvorhaben/aktuelle-forschungsvorhaben/flammschutzausruestung-von-funktionsstoffen/>



Bio-sourced P for cotton fire safety

Phytic acid, widely present in plants, showed to provide a wash-durable flame retardant for cotton. Phytic acid is the natural phosphorus storage molecule in plants and seeds. Cotton and nylon/cotton blend (Nyco) fabric samples were surface functionalised with 1,10-carbonyldiimidazole and with ethylenediamine, dipped in aqueous phytic acid solution and dried. This reacted diamine and phytic acid to cellulose in cotton by carbamate bonds, leading to an increase in fabric phosphorus content from c. 1% to 4.3% and of nitrogen from 3.3 to 5.7% Total heat release from the cotton fabric was reduced by nearly 85% (33% reduction for Nyco 50/50) and both fabrics were self-extinguishing after treatment. Flame retardancy was not significantly deteriorated after five laundry cycles (AATC 135) showing that the treatment is wash durable. However, the treatment did significantly deteriorate fabric breaking strength.

“Covalent functionalization of cellulose in cotton and a nylon-cotton blend with phytic acid for flame retardant properties”, S. Thota et al., Cellulose 27, pages11–24(2020) <https://doi.org/10.1007/s10570-019-02801-6>



Reactive phosphorus FR for bioplastic

The organophosphorus PIN FR DOPO-diamine was reacted into PLA and polyurethane, achieving UL94-V0 @ 0.8 mm. Tests covered simple addition of DOPO diamine (DOPO_d) to PLA (poly lactic acid), DOPO_d reacted into PLA at c. 2:5 ratio and a PLA-PU (polyurethane) polymer obtained by combining this DOPO_d-PLA with hexamethyl diisocyanurate. This DOPO_d(PLA-PU) polymer had 4% phosphorus, enabled extrusion of transparent film and achieved UL94-V0 @ 0.8 mm. On the other hand, DOPO_d simply added to PLA (not reacted) did not improve fire performance. The authors indicate that further work is needed to clarify the FR effect of DOPO_d reacted into PLA only compared PLA-PU.

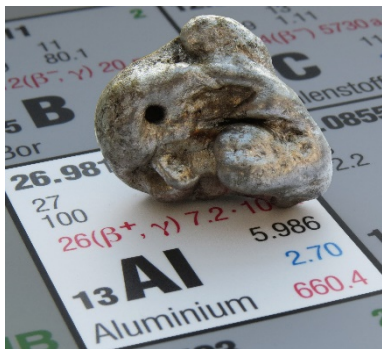
*“Development of Inherently Flame-Retardant Phosphorylated PLA by Combination of Ring-Opening Polymerization and Reactive Extrusion”, R. Mincheva et al., Materials 2020, 13, 13;
<http://dx.doi.org/10.3390/ma13010013>*



Bio-sourced PIN FR for bio-plastic

A PIN FR made wholly from plant-origin materials, in water reaction, was successfully tested in the biodegradable, bio-based polymer PBS. Phytic acid, plants' natural phosphorus storage molecule, was reacted in aqueous solution with guanosine, a purine nucleoside molecule extracted from plants, to produce a bio-sourced phosphorus and nitrogen containing PIN flame retardant (PA-GU). This was tested at 0 – 30 % loading in PBS poly(butylene succinate), a biodegradable polymer derived from succinic acid, which can be sourced from plants. 10% PA-GU achieved UL94-V2 (3 mm). 30% PA-GU increased LOI (limiting oxygen index) of PBS by over 40% and reduced peak heat release rate by c. 75%. The PA-GU PIN flame retardant acts by generating char (phosphorus) and intumescence (gas release, nitrogen) with the guanosine carbon ring cross-linking the char, resulting in a continuous expanded char layer protecting the polymer surface.

“A fully bio-based intumescent flame retardant for poly(butylene succinate)”, S. Chen et al., Materials Chemistry and Physics 252 (2020) 123222 <https://doi.org/10.1016/j.matchemphys.2020.123222>



Aluminium – APP synergy

Inclusion of aluminium oxide in polyester with PIN FR ammonium polyphosphate (APP) improved fire performance and mechanical properties. Three different metal oxides (Al_2O_3 , Fe_2O_3 and Sb_2O_3) were tested as synergists at 0.5 to 5% in PIN flame retarded unsaturated polyester resin (70% resin / 30% APP or APP plus metal oxide). APP alone or with metal oxides enabled pass of UL94-V0 (3 mm) vertical burn test and reduced smoke emission significantly (peak smoke reduced by nearly one third). All three metal oxides increased LOI (limiting oxygen index: c. 20 for pure polyester resin, 36 with APP alone, 41 with 0.5% Al_2O_3) but tin oxide increased total heat release. Aluminium oxide is identified at the best flame retardant synergist with APP (in polyester resin as tested) and also 0.5% Al_2O_3 showed better mechanical properties than APP alone.

“Enhanced flame retardancy of unsaturated polyester resin composites containing ammonium polyphosphate and metal oxides”, W. Gao et al., J Appl Polym Sci. 2020 e49148 <https://doi.org/10.1002/app.49148>



PIN smoke suppressant for intumescent

The mineral synergist, zirconium nitride, reduced smoke production by 40% and improved performance of a PIN APP-melamine epoxy intumescent fire coating for steel. The intumescent coating, typical of PIN formulations used to protect steel and other materials in fire, was composed of 20% epoxy, 26% APP, 12% pentaerythritol, 8% melamine, 10% titanium oxide (TiO_2), with up to 4% zirconium nitride (ZrN) replacing TiO_2 . With 3% ZrN, the fire protection performance of the coating was improved (time for coated metal plate to reach 580°C increased by 33%), total heat release from the coating was reduced by more than 20% and smoke production rate was reduced by 40%. The zirconium nitride led to denser, more graphitised char, suggested to be the result of formation of poly-biphenols and zirconium-phosphate or titanium-zirconium-phosphate compounds.

“Suppression on heat and smoke diffusion by zirconium nitride (ZrN) in intumescent flame retardant epoxy coatings”, F. Weihua et al., Progress in Organic Coatings 146 (2020) 105714 <https://doi.org/10.1016/j.porgcoat.2020.105714>

OTHER NEWS



Maryland State, USA, has enacted [Bill SB0447](#) banning the sale of mattresses, upholstered furniture or children's products containing > 0.1% by mass "flame-retardant chemicals", defined as intended to resist or inhibit fire and containing halogens, carbon plus phosphorus, carbon plus nitrogen or being nanoscale.

Maryland Bill SB0447

<http://mgaleg.maryland.gov/mgawebsite/Legislation/Details/SB0447?ys=2020RS> and NAFRA response

<https://www.americanchemistry.com/Media/PressReleasesTranscripts/ACC-news-releases/NAFRA-Responds-to-Enactment-of-Maryland-Flame-Retardant-Legislation.html>

NGO opposes chemical plastics recycling. The Global Alliance for Incinerator Alternatives has published a 35 page document arguing against chemicals plastics recycling, claiming that there is a lack of data showing viability, environmental challenges (possible toxic emissions or waste streams) and negative energy and carbon balance. The NGO agrees with industry that plastics should be diverted away from incineration ("waste to energy") but argues that the priority should be to reduce plastic use.

Chemical Recycling: Status, Sustainability and Environmental Impacts, A. Rollinson for Global Alliance for Incinerator Alternatives (GAIA), 4th June 2020 <https://cdn.ca.emap.com/wp-content/uploads/sites/6/2020/06/Chemical-Recycling-Technical-assessment.pdf>

Cefic highlights potential of chemical recycling. The European Chemical Council, Cefic, considers that chemical recycling of plastic waste (to produce new chemicals and plastics) can contribute to the circular economy, in complement to mechanical and dissolution recycling of plastics. Advantages are that high quality new materials can be produced, and that so-called legacy chemicals and substances of very high concern can be removed from end-of-life plastics. Cefic calls for collaboration across industry on chemical recycling, an enabling policy framework and harmonised standards and definitions.

"Introducing chemical recycling: Plastic waste becoming a resource", Cefic position paper March 2020 <https://cefic.org/our-position-papers/>

Organic contaminants released in fires. Five full-scale fire tests in furnished rooms show that levels of PAHs (polyaromatic hydrocarbons) and derivatives of brominated and phosphorus flame retardants in fire gases and soot depend on the intensity of fire and to some extent on fire extinguishing method. Water mist with additive used for fire extinguishing generated less brominated emissions and less PAHs than conventional spray nozzle fire-

fighting. The researchers note the presence of TDTBPP (tris(2,4-di-tert-butylphenyl)phosphate), assumed to derive from phosphorus-based FRs, suggesting research is needed into possible environmental release of this stable organophosphate antioxidant.

*“Organic contaminants formed during fire extinguishing using different firefighting methods assessed by nontarget analysis”, F. Dubocq et al., Environmental Pollution 265 (2020) 114834
<https://doi.org/10.1016/j.envpol.2020.114834>*

Organophosphate esters and birth outcomes. A study of 90 women* found no significant correlation between social and environmental exposure factors (questionnaire) and urinary organophosphate ester (OPE) metabolites. The study conclusions indicate that higher urinary levels of the halogenated ester derivate BDCIPP** were associated to changes in infant birth weight and umbilical cord levels of insulin and leptin (pinfa note: none of these results were statistically significant at the P=5% level). Metabolites of non-halogenated phosphate esters, and one other halogenated metabolite, showed no association to infant outcomes.

* ORIGINS of Child Health and Resilience in Development (ORCHARD) pregnancy cohort, Baltimore. ** BDCIPP = bis(1,3-dichloro-2-propyl) phosphate

“Predictors and reproducibility of urinary organophosphate ester metabolite concentrations during pregnancy and associations with birth outcomes in an urban population”, J. Kruijer et al., Environmental Health (2020) 19:55 <https://doi.org/10.1186/s12940-020-00610-0>

PUBLISHER INFORMATION

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