pinfa
Phosphorus, Inorganic & Nitrogen Flame Retardants Association

Your newsletter for non-halogen fire safety solutions n° 129 September 2021

SUSTAINABLE ELECTRICAL VEHICLES CONFERENCE

Sustainable EV Design with plastics and composites

Plastics and composites for sustainable EVs

20-21 September 2021, online, with leading automotive OEMs and suppliers. pinfa panel on sustainable flame retardants. Conference speakers include Renault, Ford, Lux Research, Audia Plastics, DAFO Vehicle Fire Protection, TUV, Technovative Solutions, Tofas, AMTE Power … The pinfa panel on sustainable flame retardants will address FRs in EV fire safety, the EU Chemicals Strategy, FRs and recycling and FR criteria for OEMs and compounders, with Clariant, Fraunhofer LBF, Nabaltec, Schneider Electric.

***Conference**: 20th and 21st September, online. pinfa panel 21st September, 16h55 – 17h35 CEST (Brussels time). Registration*
www.sustainableevdesign.com

EU PUBLIC CONSULATIONS

"Taxonomy": defining sustainable activities

Public consultation on draft recommendations for criteria specifying industries/activities eligible for EU Taxonomy funding. Open to 24th September 18h00 CEST (not midnight). The draft recommendations (developed by the EU Platform on Sustainable Finance) propose criteria for economic activities / industries considered environmentally sustainable under the provisions of the Taxonomy Regulation. The EU Taxonomy may also become a communication tool for private investors, markets and other public policy tools.

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Responsible Care® OUR COMMITMENT TO SUSTAINABILITY

A sector group of Cefic

The unified EU-wide classification system ("EU Taxonomy") aims to establish a dynamic list of economic activities, with technical screening criteria (TSC), determining in which cases each economic activity makes a '*substantial contribution'* to an environmental objective. The Taxonomy Regulation (2020/852) defines six environmental objectives: Climate change mitigation, Climate change adaptation, Water and marine resources, Circular economy, Pollution prevention and control, Biodiversity and ecosystems.

The consultation is based on a report (with accompanying Technical Annex) published by the EU Platform on Sustainable Finance (via the Technical Expert Group) outlining draft recommendations to classify an economic activity as environmentally sustainable under the Taxonomy Regulation. Economic activities covered include chemicals, firefighting, construction and maintenance of buildings, textiles, IT, transport and energy, among others.

For 2.3 "**Manufacture of chemicals**" and 2.4 "**Manufacture of chemicals products**", it is specified that "*The aim is to produce safe alternatives to priority hazardous substances in safer process conditions to reduce pollution*". Proposed criteria are that

- produced substance (output) must not have certain "hazardous" properties: PBT or VPvB or "*equivalent concern*", PMT or vPvM (mobility, when this is introduced into CLP), endocrine disruptors, respiratory or skin sensitisers, zone damaging, known or suspected carcinogen, mutagen, reprotoxic or specific target organ toxicity (Cat 1 or 2), chronic aquatic environment; AND
- the process must not use (input) any SVHC; AND
- the produced substance must substitute a substance of concern

The process must also demonstrate emission levels "*below the mid-point of the BAT-AEL ranges*", show climate change emissions below EU ETS median, achieve water treatment criteria and show no negative impacts on water scarcity, biodiversity …

For 2.6 "**Manufacture of durable electrical and electronic equipment**" and 2.7 "**Manufacture of circular electrical and electronic equipment**", if EU Ecolabel or GPP criteria are not defined for the product family, then design for recyclability DNSH criteria ("Do No Significant Harm", Annex B, pages 203-204) specify that "Plastic parts do not contain halogenated flame retardants" and that plastic parts other than cables must not contain chlorinated polymers, in both cases with some derogations.

The document also proposes criteria for (7.6) "**Emergency services – firefighting**", which include impacts on water resources of "harmful substances in firefighting foams, fire extinguishing agents, fire retardants".

Under 5.2 "**Construction of new buildings and major renovations** …" and 5.2 "**Acquisition and ownership of buildings**", neither fire safety nor thermal insulation are mentioned.

*EU consultation on proposed "Taxonomy », **open to 24th September 18h00** only (not midnight) CEST. The report and annex with proposed criteria are available at this link.*
https://ec.europa.eu/info/publications/210803-sustainable-finance-platform-technical-screening-criteria-taxonomy-report_en

Changes to CLP and new hazard classes

EU consultations are open on chemicals labelling (CLP): digital labelling, additional information, new hazard classes.

A 'Roadmap' consultation, open to 20 September 2021, addressed digital label and information tools and possibly adding new, or removing, information requirements. Input is in the form of free comments (e.g. short online comments and/or PDF document) on the proposed three page 'Roadmap' outlining context and objectives.

A public consultation questionnaire, **open to 15 November 2021** proposes possible new hazard classifications of endocrine disruptor with human health effects, endocrine disruptor with environmental effects, PBT (persistent, bio-accumulative and toxic), PMT (persistent, mobile and toxic). This consultation is a structured questionnaire, with tick-box answers and possibilities to add comments and submit additional information, and also addresses the impact of these proposed new hazard classifications on chemicals management, expected number of chemicals to be concerned, proposed definitions for these new hazards. The questionnaire also addresses animal testing, data adequacy or need for further testing and research, possible extension of scope of CLP (e.g. to food additives, animal feed, pharmaceuticals, cosmetics) and aspects of functioning and harmonisation of hazard labelling.

EU public consultation (questionnaire for general public and for experts/operators) ***open to 15 November 2021****: "Revision of EU legislation on hazard classification, labelling and packaging of chemicals"*
https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12975-Revision-of-EU-legislation-on-hazard-classification-labelling-and-packaging-of-chemicals/public-consultation_en

EU public 'Roadmap' consultation ***open to 20 September 2021***
"Chemicals – simplification and digitalisation of labelling requirements"
https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12992-Chemicals-simplification-and-digitalisation-of-labelling-requirements_en

POLICY AND REGULATION

Firefighters and harmful chemicals

Canada has announced the aim to protect firefighters from toxic substances, including certain flame retardants. Canada's Federal Ministers for Health and for the Environment together announced an "Action Plan" to protect firefighters from "harmful chemicals released during household fires", including "Banning harmful flame retardants", supporting development of safe FRs and alternatives to chemical FRs, monitoring of firefighter exposure,

identifying firefighter practices to reduce exposure, improving PPE (personal protective equipment) and information/awareness activities. To date, it is not clear whether this "Action Plan" will involve new regulatory or policy actions. References are to existing voluntary / industry information actions such as the Health Canada "Notice to stakeholders on the use of flame-retardant chemicals in certain consumer products in Canada" and to existing Canada federal chemical policy, under which 168 flame retardants have been assessed since 2006 (48 as existing Priority Substances, 120 as New Substances) and a 36 further FRs have been identified as priorities for review. The excel summary table* on the Canada government website lists 17 FRs found not harmful to health or the environment, 2 found to show low risk and 12 considered to be "harmful".

** FRs found by Canada Government assessment to be:*

- Not harmful to health or the environment: Ethylene bis(tetrabromo phthalimide) (EBTBP); Tributyl phosphate (TBP); Antimony trioxide; TBBPA bis(allyl ether); TBBPA bis(2-hydroxyethyl ether); Tricresyl phosphate (TCP), Hexachlorocyclo pentadiene; TBBPA; TDBP-TAZTO; Pentabromophenol PBP; Bromoethane; 2,2-bis(bromomethyl)-1,3-Propanediol; Chlorendic Acid; DMPP; α- bromo- chloro- alkenes C12-30; Chloro alkenes C12-24;

- Low potential for harm: ATE; bis(2-ethylhexyl) 3,4,5,6-tetra bromophthalate (TBPH); 2-ethylhexyl 2,3,4,5-tetra bromobenzoate (TBB);

- Harmful to the environment and/or to human health: Dechlorane Plus (DP); Decabromo diphenyl ethane (DBDPE); Tri(chloroethyl) phosphate (TCEP); Hexabromocyclo dodecane (HBCD); Decabromo biphenyl; Tetrabromo(tetra bromophenyl) benzene Hexabromo biphenyl (HBB); Decabromo diphenyl ether (decaBDE); Pentabromo diphenyl ether (pentaBDE); Octabromodiphenyl ether (octaBDE); Hexabromo diphenyl ether (hexaBDE); Tetrabromo diphenyl ether (tetraBDE); Nonabromo diphenyl ether (nonaBDE); Heptabromo diphenyl ether (heptaBDE)

- Proposed harmful to the environment and/or human health: TCPP; Boric acid, its salts and its precursors; TDCPP; Melamine.

"Government of Canada announces action plan to protect firefighters from harmful chemicals", 11 August 2021
https://www.canada.ca/en/environment-climate-change/news/2021/08/government-of-canada-announces-action-plan-to-protect-firefighters-from-harmful-chemicals.html

Canada Government "Flame Retardants" page
https://www.canada.ca/en/health-canada/services/chemicals-product-safety/flame-retardants.html

US EPA "final rule" for thirty FRs

The US EPA has published new information requirements for TBBPA, TCEP, TPP and for 30 halogenated flame retardants. The new final rule under TCSA (US Toxic Substances Control Act), three FRs* (TBBPA = brominated, TCEP = chlorinated, TPP = organophosphate ester) are identified as "high priority substances" requiring submission of all published and unpublished studies to EPA. The new final rule also lists thirty halogenated flame retardants for which information is requested to support evaluation and prioritisation by EPA under TCSA and by CPSC under FHSA

(Consumer Product Safety Commission, Federal Hazardous Substances Act).

** TBBPA = tetrabromobisphenol A. TCEP = Tris(2-chloroethyl) phosphate. TPP = triphenyl phosphate.*

"Manufacturers and Importers of 20 High-Priority Chemicals and 30 Organohalogen Flame Retardants Must Submit Data to EPA", https://www.natlawreview.com/article/manufacturers-and-importers-20-high-priority-chemicals-and-30-organohalogen-flame

Federal Register "Health and Safety Data Reporting; Addition of 20 High-Priority Substances and 30 Organohalogen Flame Retardants. A Rule by the Environmental Protection Agency on 06/29/2021" https://www.federalregister.gov/documents/2021/06/29/2021-13212/health-and-safety-data-reporting-addition-of-20-high-priority-substances-and-30-organohalogen-flame

Halogenated FRs on SVHC Candidate List

ECHA has added three brominated substances and MCCPs to the Candidate List of Substances of Very High Concern. The three brominated chemicals (BMP*, TBNPA*, DBPA*) are used in polymers resins or compounds, in foams or as intermediates. MCCPs (medium-chain chlorinated paraffins) are used as flame retardants and as plasticisers in plastics, rubbers and sealants.

Companies must notify ECHA (European Chemical Agency) and inform customers and consumers if any Candidate List substances are present in finished products ("articles") > 0.1% w/w. Substances on the Candidate List, which now has 219 entries, may be then placed on the Authorisation List (Reach Annex 14), meaning companies would need to apply for permission to continue using them.

REACH, the European chemicals regulation, has different levels of scrutiny or restriction for substances:

- CoRAP List: substances under study by Member States, to assess possible concerns
- SVHC: classification as a Substance of Very High Concern: carcinogenic, mutagenic, reprotox, persistent – bioaccumulative and toxic (PBT) and/or very persistent – very bioaccumulative (vPvB), or "evidence of probable equivalent concern"
  - Candidate List (Annex 14)
  - Restricted (Annex 17)

The following brominated flame retardants are already "Restricted" (REACH Annex 17, effectively banned except in specific authorised uses): Polybrominated diphenyls (Penta-, Octa-, DecaBDE) and for skin contact (e.g. textiles): TRIS** and PBBs**. Additionally, certain ammonium salts are "Restricted" in cellulose insulating materials.

Furthermore, the following halogenated flame retardants are already listed as candidate "Substances of Very High Concern" (REACH Annex 14), so that restrictions can be expected, if not already in

place: Polybrominated diphenyls (Penta-, Octa-, DecaBDE) (PBT, vPvB), HBCD (PBT), Short chain chlorinated paraffins = SCCP (PBT, vPvB), Tris(2-chloroethyl) phosphate (toxic for reproduction). Also in REACH Annex 14 are: Boric acid, Disodium borate and Trixylyl phosphate (all: toxic for reproduction).

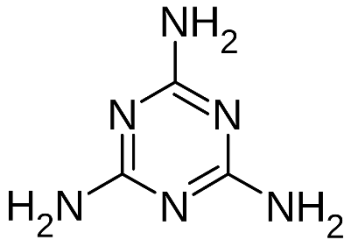
Also, ten other halogenated FRs, seven phosphate esters, Borax (sodium tetraborate) and diantimony trioxide (ATO) are currently on the ECHA CoRAP (Community Rolling Action Plan, listing chemicals for evaluation, which currently includes 392 chemicals), see pinfa Newsletter n°126.

** BMP = 2,2-bis(bromomethyl)propane1,3-diol. TBNPA = 2,2-dimethylpropan-1-ol,tribromo derivative or 3-bromo-2,2-bis(bromomethyl)-1-propanol. DBPA = 2,3-dibromo-1-propanol.*

TRIS = Tris (2-chloroethyl) phosphate. PBBs = Polybromobiphenyls.

"Candidate List updated with eight hazardous chemicals", ECHA/NR/21/20, 8th July 2021 https://echa.europa.eu/-/candidate-list-updated-with-eight-hazardous-chemicals

PINFA ACTIONS



pinfa input to consultation on melamine

FRs are < 5% of total melamine use, mainly as an intermediate for melamine compounds, several of which qualify for Ecolabels. The German Federal Institute for Occupational Safety and Health (BAuA) stakeholder consultation on melamine, July 2021, aims to identify areas of potential risk (RMO Analysis: Risk Management Options). Pinfa input estimates that all applications of melamine in fire safety is <5% of total melamine use (fire safety applications do not include "melamine foam") and that the largest fire safety use is as an intermediate for production of melamine compounds, in particular melamine phosphate, melamine polyphosphate, melamine cyanurate, melamine-poly(zinc phosphate), melamine borate. Certain melamine compounds are validated in TCO and Ökotex ecolabels. Melamine itself is not significantly present in these compounds (usually < 0.1%). Melamine itself is also used in smaller quantities for fire safety in e.g. foams, rubbers, intumescent coatings. There is no significant exposure to consumers. pinfa notes that demand for melamine compounds in fire safety is expected to increase (c.f. several market studies) as a result of increasingly demanding fire safety regulations and the move away from halogenated FRs. Also, R&D publications show potential for new melamine compounds in innovative future fire safety solutions.

BAuA (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin) RMO analysis consultation for Melamine
https://link.webropolsurveys.com/Participation/ShowResponseSummary?surveyId=b9b3f132-c546-46b1-8544-faa89c320061&responseId=5394deaf-0c4f-4dae-8c12-df2aff7bb23c

FRPM21
29 August-1 September 2021
Budapest, Hungary

FRPM2021

pinfa outlined tomorrow's fire safety challenges at the 18th Fire Retardant Polymeric Materials conference (FRPM), Budapest. FRPM21 took place in Budapest and online, 29 Aug – 1 Sept 2021, with 125 in-person and 30 online participants from 18 countries, and nearly 100 presentations and posters. These looked at research into innovative new PIN molecules as flame retardants and synergists (based on phosphorus, nitrogen, silicon, clays …), bio-based PIN FRs, applications, processing, smoke toxicity. Research on halogenated FRs was absent, confirming that the future is PIN. Christian Battenberg (Clariant), for pinfa, gave the conference dinner speech, underlining the exciting opportunities offered by the juncture of two challenges: the increasing need for fire safety, with societal drivers such as ageing population and urbanisation and new technologies such as batteries and connectedness of things, and sustainability demands for safe chemicals and recycling, hammered into place with the EU Green Deal and new Chemicals Strategy.

Summary of 17th FRPM 2019 in pinfa Newsletter n°105.

Christian Battenberg's pinfa after-dinner speech text *https://www.pinfa.eu/wp-content/uploads/2021/09/Chrisitan-speech_20210903.pdf*

FRPM21 Budapest https://www.frpm21.com/frpm21

FIRE SAFETY AND STANDARDS

DE ONDERZOEKSRAAD
VOOR VEILIGHEID

Netherlands: furniture fire danger

Dutch Safety Board calls for furniture fire safety requirements after investigating a home fire in which two people died. A man and his 4-year old son were killed by toxic smoke in an apartment building fire in Arnhem, The Netherlands, on New Year's Eve 2020, when a sofa in the flat's entrance hall caught fire and they were trapped in the lift. The mother and a second child, also in the lift, were seriously injured. Videos showed that the fire was started by a small flame from fireworks let off by children in the entrance hall. The Dutch Safety Board report notes that the sofa contained highly flammable plastic foam and that the fire developed rapidly in the sofa, releasing large quantities of toxic smoke. The Safety Board calls on the Dutch government to set fire safety requirements for furniture. The Netherlands currently does not have fire safety requirements for domestic furniture and this sofa would not therefore have contained flame retardants which could have prevented this fire being started (by a small flame).

English media summary "Dutch Safety Board: fire safety requirements for furniture in the Netherlands insufficient", 14 July 2021

Netherlands Safety Board (in Dutch): news item https://www.onderzoeksraad.nl/en/page/12051/news and investigation report https://www.onderzoeksraad.nl/en/page/16175/gelderseplein-building-fire-arnhem-1-january-2020

ISO FR families updated

ISO 1043-4 (Plastics) has been updated to specify separate identification of the brominated FR HBCD. The international standard ISO 1043-4 (2021) "Plastics – symbols and abbreviated terms – part 4: flame retardants" is now amended to add two specific new FR families: 23 HBCD and 24 HBCD with antimony (and to exclude HBCD from the families 14 and 15: aliphatic/alicyclic brominated compounds without or with antimony). Also, a wording modification is made for families 75 and 76 to replace (inorganic and organic) "silica compounds" by "silicon compounds".

ISO 1043-4 (2021) "Plastics – symbols and abbreviated terms – part 4: flame retardants", available in English for e.g. 7.38€ at the Estonia standards organisation website www.evs.ee

Li-ion battery fires in waste management

US EPA reports 250 lithium-ion battery fires in waste treatment facilities impacting workers, environment and recycling. Fires relating to batteries in recycling centres and other waste facilities are increasing, but with limited data, so that the 245 identified fires 2013-2020 caused by batteries are probably only part of the real problem. Recycling centres (MRF) showed most fires, but also transport vehicles and transfer sites. Nearly 80% of MRFs and 40% of landfill sites have had to call fire fighters for a lithium-ion battery (Li-B) fire in the last seven years. Some fires were large and destroyed entire facilities with millions of dollars damages, injured firefighters and/or caused facilities to stop collecting batteries, so inhibiting recycling. The EPA notes that MRFs use mechanised crushing and consolidation of waste, whereas as Li-B's can ignite if damaged. EPA underlines that increasing use of Li-Bs will lead to increasing numbers of fires, unless there is collaboration between industry and regulators to improve management.

"An Analysis of Lithium-ion Battery Fires in Waste Management and Recycling", US Environmental Protection Agency, July 2021, EPA 530-R-21-002 https://www.epa.gov/system/files/documents/2021-08/lithium-ion-battery-report-update-7.01_508.pdf

Fire safety requirements for bounce houses

ICC clarifies US fire and safety requirements for inflatable amusement devices for the entertainment industry. The modified International Code Council International Fire Code (ICC IFC) requirement, applicable in the USA, clarifies that NFPA 701 Test Method 2 is required for fabrics for inflatable amusement devices, plus additional fire tests if required by local or other regulation. It is also added that devices must be designed, anchored, operated and maintained in accordance with ASTM F2374, to ensure physical safety.

"Bounce houses", editorial of Fire Safety and Technical Bulletin, vol. 16, n°8, August 2021 http://www.gbhinternational.com/fire-safety-and-technology-bulletin/

INNOVATION AND RESEARCH

New PIN FR epoxy adhesive for aircraft

Henkel launches non-halogenated flame retardant epoxy meeting aircraft fire, smoke and toxicity requirements. The two-part Loctite epoxy adhesive reinforces and bonds thermoplastic and thermosets and can serve as a matrix resin on fibreglass. It does not contain halogens or antimony, meets air industry FST requirements (fire resistance, smoke emission, smoke toxicity) and is qualified to Boeing process specification BAC 5568. The resin cures in 2 hours at 70°C or 7 days at room temperature, offers mechanical and adhesion performance, non-yellowing over time and can be painted. Applications include aircraft interior parts such as walls, floor panels, compartments, galleys, seating, as well as military and railway industries. Henkel Adhesive Technologies, a world leader in structural adhesives and surface treatments, underlines that the absence of halogens or other hazardous substances answers product safety and sustainability objectives.

"Henkel and Boeing collaborate on REACH-compliant structural adhesive for aircraft interiors", 15/6/21 https://www.henkel.com/press-and-media/press-releases-and-kits/2021-06-15-henkel-develops-reach-compliant-structural-adhesive-for-aircraft-interiors-1234110 and https://www.henkel-adhesives.com/us/en/product/structural-adhesives/loctite_ea_9365fstaero.html

New performance for polymer PIN FR

FRX Polymers shows successes with polyphosphonate PIN FR in demanding medical and automotive applications. The company's polymeric phosphorus PIN FR has received OEM approvals for use in FR PET in medical equipment instrumentation and in PC/PBT blends in automotive interiors. The compound and blends offer high-gloss finish required for aesthetic reasons as well as good chemical resistance. The polymeric PIN FR does not have the plasticising effect of some additives, so does not reduce HDT (heat deflection temperature) in PC/ABS. In PC/ABS the Nofia product offers ease of processing and can achieve UL 94 V-0 down to 0.75 mm. In PET and rPET films, the polymeric PIN FR can achieve UL 94 VTM-0 (vertical thin material) down to 15 microns, with fully transparent film (low haze) and easy processing (the PIN FR can be used in a masterbatch or added directly into twin screw film extruder).

Ina Jiang, FRX Polymers, cited in Compounding World (AMI), December 2020 http://compoundingworld.com/ and FRX Polymers website https://www.frxpolymers.com/nofia-homopolymers

Durable PIN FR fire treatment for timber

Södra's non-halogen wood treatment protects from ignition up to 260°C without surface treatment. This means the natural grain of different woods, such as cedar, larch or pine, can remain visible in building interiors (C260) and exteriors (C260 Xterior), or can be painted. The treatments, by Woodsafe Sweden under high-pressure vacuum, embeds PIN flame retardant into the timber fibres, so ensuring wash and weather durability. Fire protection is CE-certified to EN 16755 class INT2 or class EXT and EN 13501-1 Euroclass B-s1-d0 and B-s2-d0, EN 13501-2 Covering K210/B-s1-d0 and K110/B-s1-d0. Applications include balconies, structural timber, decorations, wall and ceiling claddings and sound-absorbing claddings including in public buildings and sustainable timber buildings. Södra is a leader in forest products, based in Sweden, with over 3 000 staff and 53 000 forest owners, supplying innovative and sustainable markets wordwide.

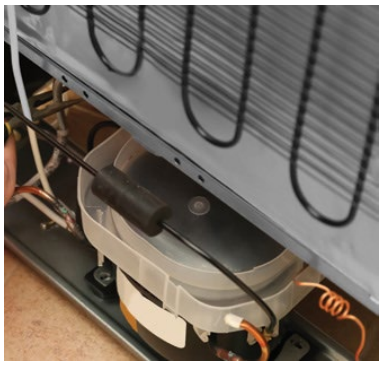
"Södra diversifies flame retardant treated range", 2 December 2020
https://www.sodra.com/en-gb/gb/wood/news/2020/sodra-diversifies-its-uk-range-of-flame-retardant-treated-timber-products/

Södra "Flame retardant treated timber" 11/2020
https://www.sodra.com/globalassets/new-great-britain-site/building-systems-gb/facades/flame-retardant-treated-timber---final.pdf

PIN FRs for smartphone battery enclosure

Realme has selected a SABIC copolymer resin featuring a PIN FR for the C25's lightweight, thin-wall battery enclosure. The polycarbonate silicone copolymer resin with PIN FR and an anti-drip agent achieves UL 94 V-0 at 0.6 mm, so enabling design of ever thinner devices. The C25 smartphone is < 10 mm thick and weighs < 210 g. The fire performance of the copolymer resin enables Realme to meet the new IEC 62368-1 standard, which replaces IEC 60065 since December 2000, and brings tighter safety requirements. The SABIC copolymer resin with PIN FR offers mechanical, optical, thermal and weathering properties, excellent flow for thin-wall part injection molding, ductility to resist damage from impacts to the device (including at very low temperatures) and chemical resistance to UV-cured painting and is available in a range of opaque colours.

"SABIC's New FR Resin Finds Use in Realme's Ultralight Smartphone Battery Cover", 1st July 2021
https://omnexus.specialchem.com/news/industry-news/sabic-resin-realme-smartphone-000225121



Low-smoke PIN FR polypropylene

Tosaf's PIN FR PP compound meets stringent fire performance and smoke criteria for domestic appliances and construction. The PIN FR polypropylene-based compound meets UL 94 V-5A at 1.6 mm, EN13501-1 BS1 do, NFPA 286, ASTM E162, NF P 92 503/507 M1 and LPS 1207. Advantages include processability and recyclability. The PIN FR solution is also available as a masterbatch, suitable for polypropylene and polyethylene. Applications include in white good, such as fridges, dishwashers and air conditioners, and in corrugated PP ducts and sheets for construction and billboards. Tosaf also offers performance PIN FR compounds and masterbatches, that is without halogens and without antimony, for ABS and HIPS.

"Tosaf Offers Halogen- and Antimony-free FRs at a Good Price/Performance Ratio", 21st June 2021 https://polymer-additives.specialchem.com/news/product-news/tosaf-offers-halogen-free-and-antimony-free-frs-000225009

Metal-organic hybrids as PIN FRs

These can improve polymer compatibility of metal salts, provide catalytic FR functions and absorb pyrolysis products. This review summarises FR effects of different types of metal-organic hybrids. In OMIFERs (organically modified inorganic FRs) metal salts are surface modified by organic molecules to improve polymer compatibility. In MOSs (metal-organic salts) a metal is combined with an organic phosphorus molecule: the connection of the metal ion to the organic molecule improves its FR effectiveness and can impart specific catalytic effects during combustion. In MOFs (metal-organic frameworks) the specific structure impacts various FR effects, which can include porous structures which absorb flammable pyrolysis products in fire. Consequently, FR mechanisms of metal-organic hybrids include improving char formation and stability, releasing flame-inhibiting phosphorus radicals, catalytic smoke suppression by metal compounds and reduced emission of flammable pyrolysis products during polymer decomposition. Organic molecules used in metal-organic hybrids can include organophosphorus compounds, bio-based molecules (e.g. alginate, phytate …), melamine … Inorganics used can include various metals (e.g. Co, Mn, Mo, Ti, Zn …) or clays. Data from over 200 references are compared. In a second paper, the authors further assess nine different MOFs (metal-organic frameworks) in polyester and epoxy. They conclude that cobalt containing MOFs are more effective than those containing aluminium, copper, iron or zinc. This second study confirms the effectiveness of appropriate MOFs as PIN FRs reducing peak heat release rate, smoke and carbon monoxide emissions.

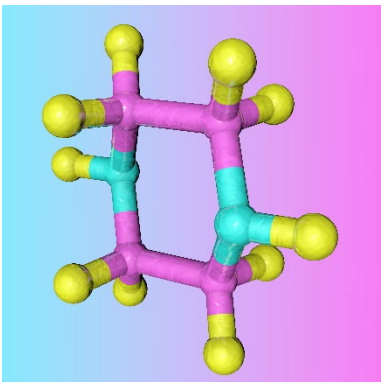
"A review on metal-organic hybrids as flame retardants for enhancing fire safety of polymer composites", Y. Hou et al., Composites Part B 221 (2021) 109014, DOI. "Which part of metal-organic frameworks affects polymers' heat release, smoke emission and CO production behaviors more significantly, metallic component or organic ligand?", Y. Hou et al., Composites Part B 223 (2021) 109131, DOI.

PIN FR battery module housing for EVs

From Lanxess and INFAC, this offers mass-production, mechanical and non-halogenated fire performance. Lanxess is a PIN flame retardant producer, member of pinfa. INFAC is a Korean specialist manufacturer of cables, electronic and electrical automotive parts. The battery housing uses Durethan BKV30FN04 from LANXESS. This non-halogenated FR glass fibre reinforced polyamide-6 offers good flame retardancy performance and provides electrical and mechanical functions, including high-voltage resistance up to 800V, strength and stiffness and resistance to chemicals such as battery electrolytes. These characteristics enable complex part design, use of fewer parts (simplified assembly) and lighter weight. High processability ensures compatibility with mass production of EV models launched by a Korean automotive manufacturer earlier in 2021.

"Lanxess, INFAC develop composite battery module housing", CompoundingWorld, 24 August 2021
https://www.compositesworld.com/news/lanxess-infac-develop-composite-battery-module-housing-

"LANXESS: High performance plastics grade for production of battery housings", 24 August 2021 https://lanxess.com/en-GB/Media/Press-Releases/2021/08/LANXESS-High-performance-plastics-grade-for-production-of-battery-housings



Biobased N-P FR for epoxy

A piperazine – phytic acid compound showed to be an effective PIN FR in epoxy, passing UL 94 V-0 and reducing smoke. Phytic acid, a natural molecule with high P content which is widely present in plant seeds, was reacted in ethanol with piperazine, which contains nitrogen, and was then dispersed in epoxy resin before curing. At 15% loading, the P-N PIN FR enabled epoxy to achieve UL 94 V-0 (3 mm), increased LOI from 24% to 36% and decreased PHRR (peak heat release rate) by over 50%. Total smoke release was reduced by 45% and carbon monoxide release by 30%. Mechanical properties of the epoxy resin were somewhat reduced (e.g. tensile strength -14%). The authors conclude that the P-N FR acts by forming resistant, compact char and that this bio-based PIN flame retardant is economically viable and simple to synthesise.

"Synthesis of a bio-based piperazine phytate flame retardant for epoxy resin with improved flame retardancy and smoke suppression", Z. Huang & Z. Wang, Polym Adv Technol. 2021;1–14, https://dx.doi.org/10.1002/pat.5429

OTHER NEWS

Royal fire death: eighteen fire fighters were mobilised near Saint Etienne France on 9th August to deal with an apartment fire. One resident was hospitalised because of smoke. The fire however caused one death, that of a Royal Python, in whose terrarium the fire apparently started. It could not be established from the defunct reptile whether it was responsible for starting the fire. The fire service stated that its fire fighters are trained to deal with animals, but that in this case the inanimate python had not impacted their intervention.

Le Progrès: https://www.leprogres.fr/faits-divers-justice/2021/08/09/un-terrarium-prend-feu-gros-dispositif-de-pompiers-rue-gambetta

Review on organophosphate esters (OPEs): This review is based on nearly 200 publications, covering production/use, environmental occurrence and health / environmental toxicity of over 20 OPEs (mostly non-halogenated, some chlorinated or brominated) used as flame retardants, plasticisers or in other applications. The study notes that weak bonding to substrates and increasingly wide use is resulting in widespread environmental occurrence. Bioaccumulation / magnification in aquatic food webs can be significant, but is mitigated by breakdown. More research is identified as needed on OPEs in drinking water, toxicity / ecotoxicity (to avoid reliance on read-across from pesticides), processes of metabolic breakdown and possible occurrence and toxicity of metabolites.

"A review of environmental occurrence, analysis, bioaccumulation, and toxicity of organophosphate esters", T. Bekele et al., Environmental Science and Pollution Research, 2021 https://doi.org/10.1007/s11356-021-15861-8

PUBLISHER INFORMATION

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