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PINFA GENERAL ASSEMBLY



pinfa GA sees opportunities

Despite Covid, pinfa members see opportunities for PIN FRs with the Green Deal and new applications. Pinfa's second online General Assembly discussed results of projects underway on impacts of FRs on smoke, with Hervé Feuchter, CREPIM, and planned on FRs in plastics recycling, with Elke Metzsch-Zilligen, Fraunhofer LBF.

An overview of the EU's new Green Deal Chemicals Strategy, by Blanca Serrano, Cefic, showed opportunities for PIN flame retardants, with the EU vision to maximise benefits of chemicals and be the world benchmark for chemical safety. The Strategy will demand more data on chemicals' health and environmental performance, and offer innovation funding. Imports of chemicals, for example in imported plastics, should be better controlled than currently under REACH. PIN FRs can aim to achieve the new Chemical Strategy's "safe and sustainable by design" principles. pinfa suggests that fire safety should be recognised as an "essential use" under the Strategy and will develop this discussion in 2021.

Timothy Reilly, for pinfa North America, and Cindy Liu, for pinfa China, presented pinfa's international activities, in particular the [pinfa-na](#) industry formulator training workshop and an analysis of the China FR and FR-materials industries by Beijing BIT University (translation underway) and monthly pinfa-China online classes.

For 2021, in addition to ongoing projects, dialogue with regulators and stakeholders and engagement with Horizon Europe, pinfa will organise further thematic webinars, similar to the successful pinfa webinars on fire safety in e-mobility (summarised in pinfa Newsletter n°120).

FORMULATORS' WORKSHOP



Training to formulate fire safe materials

Four interactive webinars will provide insight into flame retardant product design for formulators and compounders.

The training is organised by pinfa North America, in collaboration with SPE ([Society of Plastics Engineers](https://www.spe.org/)), online, from June 1st, 8th, 15th and 22nd, 2021, this four part training series will look at flame retardant mechanisms, selection and formulation, to meet application and fire safety specifications, including sustainability and circular economy, and fire performance testing. Thermoplastics, elastomers, thermosets, textiles, adhesives, sealants and coatings will be covered by instructors with decades of industrial experience in formulating and compounding.

Information, detailed programme, registration www.pinfa-NA.org

POLICY, CALLS AND CONSULTATIONS



New EU Batteries Regulation proposal

The European Commission's proposed text targets sustainability and safety, but neglects battery fire safety.

The proposed new EU Batteries Regulation is open to [public consultation to 1st March 2021](#), and will then be debated by the European Parliament and Council (Member States) in coming months. The proposal will fix requirements for all batteries sold in the EU, including imports: restrictions on hazardous chemicals, carbon footprinting, obligatory recycled content (minimum % from secondary materials for several elements in the battery), performance and durability, replaceability of batteries in devices and safety.

However, **fire is not one of the nine proposed safety criteria** (Annex V: it is only mentioned that short-circuiting must not lead to fire). pinfa considers that this is regrettable, given the significant fire risks posed by all batteries, and will input to the public consultation, to suggest that Annex V be amended to address specific fire risks, including heat emission, smoke and toxic gases, extinction and toxicity of extinction waters.

pinfa calls on the fire safety community to [contribute to this EU public consultation](#) (open to 1st March 2021) and raise the importance of fire safety as a critical safety criteria for batteries.

Public consultation open to 1st March 2021:

<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12399-Modernising-the-EU-s-batteries-legislation>

European Commission proposed new Batteries Regulation, COM(2020) 798/3 - 2020/353 (COD), "Proposal for a Regulation ...concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020"

https://ec.europa.eu/environment/waste/batteries/pdf/Proposal_for_a_Regulation_on_batteries_and_waste_batteries.pdf

Proposed Regulation Annexes

https://ec.europa.eu/environment/waste/batteries/pdf/Annexes-Proposal_for_a_Regulation_on_batteries_and_waste_batteries.pdf

European Commission summary Fact Sheet

https://ec.europa.eu/commission/presscorner/detail/en/fs_20_2359



EU consultation Zero Pollution Ambition

Input is invited to 10th February for the EU Zero Pollution Action Plan for air, water and soil, to be adopted in 2021. The Commission's 'Roadmap' outlines as key orientations to: strengthen implementation and enforcement, improve the regulatory "acquis" on health and environment (including industrial emissions), address soil pollution, improve governance and drive societal change / sustainable consumption. The public consultation questionnaire asks for input on questions such as to what extent pollution is felt to be negative, which populations are most exposed, which EU policies are known, which types and sources of pollution should be priorities, possible types of action (regulatory, financial, education, ...).

"EU Action Plan Towards a Zero Pollution Ambition for air, water and soil", consultation open to 10th February 2021

<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12588-EU-Action-Plan-Towards-a-Zero-Pollution-Ambition-for-air-water-and-soil>



pinfa input to Sustainable Products Initiative

Benefits of chemicals' functions in consumer products should be considered, and LCA, product durability and recycling. pinfa's input to the EU public consultation noted the need to take into account the functions delivered by chemicals in finished products and underlined the importance of fire safety for priority products identified in the Sustainable Product Initiative: electronics/ICT, textiles and furniture. pinfa welcomed the proposed widening of the Ecodesign Regulation's scope beyond energy-related products. Pinfa concluded by calling "for a supportive, holistic, consistent and forward-looking policy framework, to enable the fire safety industry to deliver on the Green Deal."

pinfa input to EU public consultation on the Green Deal Sustainable Product Initiative, 16th November 2020 <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-Products-Initiative/F1231298>



pinfa input to CPR consultation

pinfa supports reinforcing the Construction Products Regulation (CPR) as central to ensuring building fire safety. The pinfa response to the public consultation is aligned with the arguments of CPE ([Construction Products Europe](#)) and emphasises that the CPR currently provides a Common Technical Language and standards, enabling each EU Member State to define appropriate fire safety requirements, whilst enabling a single EU market both for construction products and for fire safety solutions for these products. pinfa notes its support for communicating environmental performance (e.g. using the existing standard EN 15804) and developing recycling, both of which are possible within the current CPR framework.

EU public consultation on the review of the Construction Products Regulation, open to 25th December 2021

<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12458-Review-of-the-Construction-Products-Regulation/public-consultation>



UK consults on architects' fire competence

UK Government proposes greater accountability and responsibility for fire & structural safety for architects, throughout buildings lifecycles, including design phase. This follows the conclusions of the independent (Hackitt) review (see pinfa Newsletter n°92) following the Grenfell Tower fire. The UK Government proposes to modify the Architects Act 1997 to improve architects' competence and training on fire safety and fire regulations, and to formulate a system of international fire safety qualification recognition.

UK Government public consultation open to 22nd January 2021

<https://www.gov.uk/government/consultations/consultation-on-proposed-amendments-to-the-architects-act-1997/proposed-amendments-to-the-regulation-of-architects>

INDUSTRY



Compounding World shows future is PIN

AMI's industry magazine annual review on flame retardants features nearly 20 new products, of which only one is not PIN. The article starts by noting the development of a diverse range of HFFRs (halogen-free flame retardants) "increasingly seen as more sustainable than halogenated FRs" whilst on the other hand "producers of traditional and long-established brominated systems (BFRs) are presenting arguments to challenge what they see as unfair new laws restricting their use".

pinfa is cited as seeing growing interest in PIN FRs and strong opportunities in the EU Green Deal and the new Chemicals Strategy: “existing PIN FRs, known to be safe and effective, will continue to be improved. New formulations, co-polymers or oligomer forms, combination packages of PIN FRs or use of specific PIN synergists, will ensure that PIN FRs respond to demanding user specifications.”

Innovations in PIN FRs, PIN synergists and their applications cited include: Adeka, FRX Polymers, Arichem, Momentive, Techmer PM, Huber Engineered Materials, Nabaltec, Russian Mining Company, HPF The Mineral Engineers, Budenheim, Clariant, George H Luh, NeoGraf Solutions, Fraunhofer LBF, Paxymmer, MCA Technologies.

Compounding World (AMI), December 2020 “Regulation drives FR development” <http://compoundingworld.com/>



pinfa joins Batteries Partnership

Fire safety is a key challenge for the roll-out of e-mobility and energy storage batteries. The Batteries European Partnership Association (BEPA) has been established to engage in Horizon Europe, based on the inclusion of “Batteries: Towards a competitive European industrial battery value chain” as one of the ten possible areas for ‘Partnerships’ in the EU’s future Horizon Europe R&D programme [Orientations](#). If validated, BEPA will provide input to defining battery R&D funding and project coordination (based on the EU’s [Batteries Strategic Research and Innovation Agenda](#), SRIA 12/2020) and to defining EU regulations and standards on batteries, including safety and sustainability. The Eu Battery SRIA indicates fire safety as a key objective for stationary storage batteries and battery fire resistance and electrolyte flammability as critical areas for battery industry competitiveness. The Battery Partnership BEPA engages pinfa alongside [EARPA](#) (European Automotive Research Partners Association), [EMIRI](#) (Energy Materials Industrial Research Initiative), [RECHARGE](#) (industry association for advanced rechargeable and lithium batteries), [EUCAR](#) (European Council for Automotive R&D) and [EASE](#) (European Association for Storage of Energy).

“Batteries European Partnership - membership information”, 27th November 2020

https://www.earpa.eu/earpa/31/1958/batteries_european_partnership_become_a_member_of_the_association_and_save_the_date_for_the_first_qe%E2%80%A6

WEBINARS



European Fire Safety Week webinar: smoke

Experts and fire-fighters explained the increasing risk from smoke in fire in modern buildings, because of new materials, green building and furnishings, in a webinar organised as part of European Fire Safety Week 2020 (160 participants).

Patrick van Hees, Lund University, explained that smoke is critical to fire fatalities and to escape from fire. Modern buildings increasingly have large and open spaces, high fire loads in contents and voids which can allow fire and smoke spread. New materials used in construction and interiors can reduce escape time, release toxic fire gases and shorten time before building structural collapse. This is accentuated by energy efficient buildings, which are air tight, with only mechanical ventilation, leading to increases in pressure with fire and low oxygen.

Tests by Steve Kerber, UL, have shown the higher fire risk in a room furnished with modern synthetic materials, compared to natural materials ([link](#) and [presentation](#)).

Lieuwe de Witte, IFV (Netherlands Institute for Safety), also emphasised that furnishings using modern synthetic materials generate much more heat and smoke than those made of natural materials. Upholstered furniture is the most common object of origin in fires with fatalities (> 25 % of fire deaths in The Netherlands). Within 3 to 5 minutes of a fire starting in a residential room, heat and smoke are untenable and escape is impossible.

A large-scale series of tests in a disused residential building by IFV ([link](#) and [presentation](#)) shows that fire starting in a room containing only an upholstered sofa can rapidly lead to fatal conditions in the corridor outside the room if the room door is opened even briefly. Heat, irritating gases, asphyxiating gases and visibility (smoke) were assessed. People in other rooms along the corridor are at risk from smoke if they open their door, but cannot escape if they do not. Carbon monoxide, in particular, can spread rapidly through buildings.

Bart Merci, Ghent University, and Pieter Poppe, ISIB, presented further large-scale studies of smoke propagation in buildings, underlining the dangers for elderly or vulnerable people, who are at risk of not being able to escape ([link](#)).

Concluding, René Hagen, Netherlands Fire Service Academy, noted that studies repeatedly confirm the contribution of upholstered furniture and mattresses to residential fire deaths. Smoke detectors are important, but not sufficient. Sprinkler systems are effective, but not installed in many buildings. Low Ignition Propensity cigarettes, however, have been shown to be largely ineffective (see e.g. Bonander et al. in pinfa Newsletter n°84) so that smoking and upholstered furniture or bedding remains a deadly combination.

European Fire Safety Week 2020, webinar #3: Smoke propagation in residential buildings, 18th November 2020:

<https://www.europeanfiresafetyalliance.org/european-fire-safety-week-2020/>



Fire safety & energy transition in buildings

Members of the European Parliament say fire risks of green buildings and renovation must be addressed.

Željana Zovko, MEP, said the energy transition must be safe. Green buildings have more electrical installations, increasing fire risk. The European Parliament has called to include fire safety aspects in the EU ‘Renovation Wave’ (see pinfa Newsletter n°118).

Maria da Graça Carvalho, MEP, considered that the ‘Renovation Wave’ must ensure fire safety with fire resistant materials, fire safety design and urban planning. She noted the possible fire risks from DIY energy renovation. Better fire data can support design to reduce fire propagation and increase escape time.

Carlos Zorrinho, MEP, underlined the need to better integrate fire safety into building codes, and to ensure progress in all Member States despite different contexts and methods. An EU-level survey of national fire safety practices, knowledge and competence is needed.

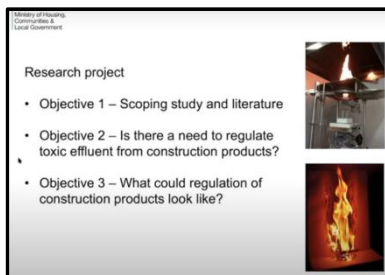
Krzysztof Biskup, European Fire Safety Alliance, noted that electrical installations cause around a quarter of home fires, showing a 10% increase in a decade. Home electrical energy storage and DC/AC conversion will increase risks. The link between energy and fire risk is recognised in the Energy Performance in Buildings Directive (EPBD, 2010/31/EU recast by 2018/844/EU) articles 2a(7) and 7 (see pinfa Newsletter n°. 103).

Adamantia Athanasopoulou, European Commission, Joint Research Centre (JRC), provides support to DG GROW for the Construction Products Regulation. An EU Fire Safety Expert Network on construction is being established, with firefighters, researchers and industry, with the objective to incorporate fire safety engineering into standards, map roles, define training and harmonise qualifications for fire safety engineering.

Quentin de Hults, Modern Building Alliance and BASF, presented results of a survey of over 800 architects across Europe. This shows that they involve fire safety experts in only a third of projects. In some countries, responsibility for fire safety shows to be very unclear. Today, regulation requires an energy expert in building projects, but not a fire safety expert.

European Fire Safety Week 2020, webinar #5: The stake of the energy transition for buildings – fire safety competency, 19th November 2020:

<https://www.europeanfiresafetyalliance.org/european-fire-safety-week-2020/>



Questions on smoke toxicity

A webinar with experts and regulators underlined the complexity of smoke toxicity, showing that regulation of fire toxicity emissions of construction products is currently neither feasible nor appropriate.

Sirpa Pietikäinen MEP, underlined the need to avoid increasing fire risks of combustible materials in “green” buildings.

Fulvia Raffaelli, European Commission DG GROW, underlined that all smoke is toxic, but that there are today no clear links between construction products smoke toxicity and fire fatalities. Renovation and insulation materials can significantly impact fire safety, but further studies are needed on the relevant significance of building materials and contents. DG GROW is interested to cooperate with stakeholders to further study smoke toxicity.

Peter Woodburn, Arup UK, noted that although both construction products and building contents contribute to fire, fire usually starts in contents. To date, toxicity is considered too complex to integrate into building design. Modelling studies are underway but more data is needed under different fire conditions.

Brian Martin, UK Ministry of Housing Communities and Local Government, also noted that smoke is always toxic, and that the most important is to avoid fires starting. The UK is launching an R&D project to collect data to define whether regulation of smoke toxicity of building products would be appropriate. This will consider the smoke toxicity contributions from construction products and contents, how to define testing methods to reflect real fire conditions and possible thresholds for emissions of certain toxicants. One option could be to address certain specific materials with particularly toxic smoke emissions.

“Improving fire safety by assessing the toxicity of smoke from burning construction products”, webinar, 19th November 2020
<https://www.youtube.com/watch?v=Lvo7R09e31g>

FIRE SAFETY



United Nations adopts fire standard

UN-ECE’s adoption of the International Fire Safety Standard – Common Principles is a major step for building fire safety. The new standard was developed by the International Fire Safety Standards Coalition (<https://ifss-coalition.org/>) and covers legislation, codes or regulations and standards in all stages of a building’s life cycle (see pinfa Newsletter n°119). It aims to respond to increasing public concern over regulation and control of fire safety in buildings worldwide. The document will now be published as an UN ECE (Economic Commission for Europe) standard.

“Worldwide fire safety standard recognised by United Nations”; 24th November 2020 <https://www.fsatters.com/Worldwide-fire-safety-standard-recognised-by-UN>

ARCHITECTS SURVEY ON FIRE SAFETY COMPETENCY

Survey of 835 architects from eight European countries about the involvement of fire experts in their projects



Fire safety competence for buildings

A survey of over 830 architects in 8 EU countries shows the fire safety experts are involved in only 1/3 of building projects, varying from 25% in Poland to 69% in Germany. This is lower than the 45% of projects in which architects involve energy experts. Fire experts are particularly absent from renovation projects, despite the dangers posed by building modification and insulation, as tragically shown by the Grenfell fire in London. The majority of surveyed architects do consider themselves responsible for fire security and the main reason architects are not involving fire experts is because they consider that they have sufficient in-house expertise: the survey does not address whether or not this is justified.

Modern Buildings Alliance "Architects Survey on Fire Safety Competency" 13th November 2020

<https://www.modernbuildingalliance.eu/news/architect-survey-fire-safety-engineering>



"Green" buildings increase fire risk

Report says fire performance should be integrated into sustainable building materials and design and more research is needed. Published by the US NFPA (National Fire Protection Association), the 155-page report notes that "green" construction design and installations, such as insulation, energy storage systems, timber, modular construction or other design attributes can present fire hazards if unmitigated. Conclusions suggest improving fire incident reporting, adapting fire test methods, integrating fire performance into sustainable materials and technologies, development of tools for risk assessment, design and performance assessment, holistic regulation and development of the SAFR (Sustainable And Fire Resilient) building concept.

"Fire Safety Challenges of 'Green' Buildings and Attributes", B. Meacham, M. McNamee, US NFPA, 9th October 2020

https://www.researchgate.net/profile/Brian_Meacham/publication/346421751_Fire_Safety_Challenges_of_'Green'_Buildings_and_Attributes_Final_Report/links/5fc0ed5fa6fdcc6cc6731045/Fire-Safety-Challenges-of-Green-Buildings-and-Attributes-Final-Report.pdf

pv magazine

Subscriptions

Australian rooftop PV safety standards under fire in new report

The Australian rooftop PV market is expected to eclipse all previous records in 2020, but a new report has raised serious questions about the fire safety standards associated with small-scale solar installations.

NOVEMBER 20, 2020 DAVID CARROLL



Rooftop PV fire & safety standards

PV-Magazine raises concerns about fire safety standards for domestic and small scale solar panel PV systems. PV-Magazine (20th November 2020) underlines that safety requirements vary between countries and suggests that Australia's standard is problematic, because it makes "DC isolators" obligatory. A report by BRE for the UK Government (2018) suggested that 30% of PV fires started in a DC isolator. These are used to prevent high-voltages being present in wires to the inverter after the installation is switched off, but can be replaced by other rapid shutdown mechanisms. PV fires are rare (< 1 incident per 10 000 installations) but the BRE report concluded that around one quarter of PV fires are serious and

spread beyond the PV system. The BRE report also noted that a third of fires were related to poor installation. Walmart had seven rooftop solar fires ([2012-2018](#)) in systems installed by Tesla in 2017.

“Australian rooftop PV safety standards under fire in new report”, 20th November 2020 <https://www.pv-magazine.com/2020/11/20/australian-rooftop-pv-safety-standards-under-fire-in-new-report/>



Mattress fire safety standard saves lives

NIST study concludes that US 16 CFR Part 1633 (open flame resistance) already prevents 65 deaths per year, despite not all old mattresses from before this standard having been replaced. This mattress flammability standard was introduced in July 2007, replacing standards requiring cigarette resistance only. [16 CFR part 1633](#) applies gas burners to the side and top of a mattress for up to 30 minutes. The study compares to fires related to residential upholstered furniture in the USA, for which the standard is not applicable, concluding that the number of bed fires has been reduced by 12% and related injuries by 34% and deaths by 82%. The study concludes that the open flame standard “is accomplishing its purpose” and that beds with conform mattresses are “far less likely to lead to a fatal fire”.

US National Institute of Standards and Technology (NIST) News 18th November 2020 “Mattress Flammability Standard Is a Lifesaver, NIST Report Finds” <https://www.nist.gov/news-events/news/2020/11/mattress-flammability-standard-lifesaver-nist-report-finds>

“Estimating the impact of the mattress fire safety Standard 16 CFR Part 1633 on bed fire outcomes”, S. Gilbert et al., Fire and Materials. 2020;1–11 <https://dx.doi.org/10.1002/fam.2932>

Photo: SGS Govmark “Mattress Open Flame Test (CFR 1633)” <https://www.youtube.com/watch?v=0b5CVjVMGTs>



Grenfell Inquiry media questions

The Grenfell fire inquiry has been told that cladding sold as fire class zero may not have been appropriately tested. Input to the inquiry has suggested that one insulation cladding product, found on parts of Grenfell Tower, may have been sold as Class 0 based on tests on a previous version of product, not the actual product sold. It was suggested that the class 0 claim for the new product was based on tests of only the foil facing, not the whole product, and that when the whole composite was later tested it failed to achieve Class 0. For another cladding product used on Grenfell Tower, it was suggested that the producer may have modified fire test setups to improve outcomes, in order to keep its product on the market.

Some media have also tried to cast doubts on the independence of fire safety researchers and experts, because they have received funding from cladding product manufacturers for [research](#) (e.g. Guardian UK [11/11/2020](#)), or because they attended an information meeting organised by industry (Financial Times [5/11/2020](#)). pinfa is not involved, but notes that the funding received

was transparently declared in the one study cited, and that the UK Government has responded (in the Guardian article above) that it: “*expected industry experts to attend conferences and seminars and that this did not prohibit them from being independent.*”

Weekly updates on the Grenfell Inquiry are available at www.insidehousing.co.uk

Media Coverage: Irish News [12/12/2020](#), Inside Housing [11/12/2020](#), Construction Manager Magazine [9/12/2020](#), Global Insulation News [19/11/2020](#), Irish Times, [9/12/2020](#), The Guardian, UK, [11/11/2020](#), Financial Times, [5/11/20](#).

“*Study of fire behaviour of facade mock-ups equipped with aluminium composite material-based claddings, using intermediate-scale test method*”, E. Guillaume et al., *Fire and Materials*. 2018;1–17
<https://doi.org/10.1002/fam.2635>

RESEARCH



Numerical modelling study of Grenfell fire

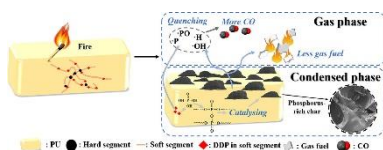
Efectis study suggests mineral wool spreads fire faster than polymer insulation. The study was part funded by Kingspan, manufacturer of one of the insulation cladding products which burnt in the Grenfell Tower fire. The three-part paper (total 55 pages) models the spread of fire in Grenfell Tower considering fire development in the initial flat (where the fire started in a fridge/freezer), spread out through the window and over the building façade. Modelling is based on data such as specific heat of different materials and results are calibrated using data from the Grenfell fire and from other fires and fire tests. The study states that a fire modelled with mineral wool insulation shows the same spread for nearly 15 minutes as with the PIR (polyisocyanurate) polymer foam actually used in the Grenfell refurbishment and involved in the tragic fire and that after than “*the fire spread is faster for the model with mineral wool*”. In both cases, the external cladding modelled was ACM-PE (aluminium composite material – polyethylene). The model also concludes that the PIR insulation material only (without any cladding) would have spread the fire only between two floors and would have self-extinguished.

E. Guillaume et al., Fire and Materials 2020, “Reconstruction of Grenfell Tower fire”, parts 1, 2 and 3:

- part 1: *Lessons from observations and determination of work hypotheses*, 44:3–14, <https://doi.org/10.1002/fam.2766>

-part 2: *A numerical investigation of the fire propagation and behaviour from the initial apartment to the façade*, *Fire and Materials*. 2020;44:15–34, <https://doi.org/10.1002/fam.2765>

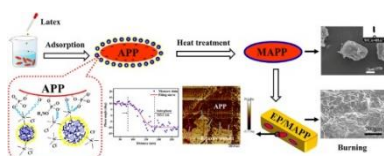
- part 3: *Numerical simulation of the Grenfell Tower disaster: - Contribution to the understanding of the fire propagation and behaviour during the vertical fire spread*”, 44:35–57, <https://doi.org/10.1002/fam.2763>



Reactive DOPO for polyurethane elastomers

Phosphorus PIN-FR reacted into the polymer results in fire and mechanical performance with no FR leaching. The commercial PIN phosphorus FR (DDP*) is synthesised from DOPO** and itaconic acid. This was reacted into a polyester diol from DDP, adipic acid, ethylene glycol and 1,4-butadienol, and then used to prepare polyurethane elastomers (FR-PUE) with 0.14 -0.72% P content. At 0.29% P, the FR-PUE showed LOI (Limiting oxygen index) of 23 (compared to 19 for neat PUE) and achieved UL94-V0 (thickness not specified), whilst offering improved tensile strength.

“Synthesis of reactive DOPO-based flame retardant and its application in polyurethane elastomers”, H. Wang et al., Polymer Degradation and Stability 183 (2021) 109440, <https://doi.org/10.1016/j.polymdegradstab.2020.109440>



Improving performance of APP in epoxy

The PIN FR ammonium phosphate was (APP) modified by latex, resulting in better mechanical properties of PIN FR epoxy. The modification aimed to improve hydrophobicity and thermal stability of the APP. Cationic latex was synthesised by semicontinuous emulsion polymerisation, then simply mixed in suspension with APP for 20 minutes, then washed and dried. APP and latex-treated APP were dosed in DGEBA thermoset epoxy at 8.5 – 13.5 %. Fire performance of the FR-epoxy was similar with APP or latex-APP (UL94-V0 @ 13.5% APP, versus no rating for neat epoxy), whereas mechanical properties (impact and tensile strength) were significantly improved.

“Enhance the interaction between ammonium polyphosphate and epoxy resin matrix through hydrophobic modification with cationic latex”, X. Zhang et al., Colloids and Surfaces A: Physicochemical and Engineering Aspects 610 (2021) 125917, <https://doi.org/10.1016/j.colsurfa.2020.125917>



Mineral PINs reduce smoke emissions

Carbon-encapsulated metal oxides with PFRs reduced heat release and smoke emission in polyurethane foam. Carbon-encapsulated metal oxides were prepared by reacting iron and copper (hydr)oxides with sodium alginate at 170°C, centrifuge separation and drying, to produce iron, copper and iron-copper hybrids. Fire performance was tested for neat rigid polyurethane foam (PUF) from polyether polyol, PIN FR PUF with 5% APP (ammonium polyphosphate) and 5% DMMP (dimethylmethylphosphonate) and PIN FR PUF with 0.1 – 5% of each of the carbon metal hybrids. The PIN FRs reduce peak heat release rate of the polyurethane foam by around 40%, and the metal oxides show to be effective smoke suppressants.

“The influence of carbon-encapsulated transition metal oxide microparticles on reducing toxic gases release and smoke suppression of rigid polyurethane foam composites”, Z. Xu et al., Composites Part A: Applied Science and Manufacturing, vol. 131, April 2020, 105815, <https://doi.org/10.1016/j.compositesa.2020.105815>

OTHER NEWS



Long term diabetes effect of penta-BDE in mice. Mice exposed to DE-71 (mainly penta-BDE) only via their mothers (in the womb and during lactation) showed markers of diabetes later as adults. The mothers were given PBDEs at 0.1 or 0.4 mg per day / kg body weight (considered comparable to human environmental exposure). Media coverage refers to PBDEs but the substance tested, penta-BDE, was banned worldwide by the Stockholm Convention in 2009.

Cohort study suggests maternal exposure to some phosphorus ester FRs may impact baby's size at birth. 16 organophosphorus ester FRs or metabolites were repeatedly measured in urine of 213 pregnant women in Wuhan, China. bis(1,3-dichloro-2-propyl) phosphate (BDCIPP, a metabolite of TDCPP), bis(2-butoxyethyl) phosphate (BBOEP), 4-hydroxyphenyl-diphenyl phosphate (4-HO-DPHP) and diphenyl phosphate (DHPH) concentrations in the typical range of 0.5 – 5 ng/mL showed some correlations to baby birth weight or length at birth.

Discussion of FRs in mobile phones in Ecodesign work. pinfa has input (November 2020) to the ongoing preparation of EU Ecodesign criteria for 'Mobile phones, smartphones and tablets' indicating the phosphorus ester FRs found in screens are probably being used for other purposes, e.g. as plasticisers. The draft project report ([Task 3](#)) referred to Zhang et al. 2019 who tested for 52 FRs in mobile phones from 2015 or earlier, finding mainly TPHP, TBOEP, EHDPP, TEP, TCEP and TCIPP*, mainly present in the phone screen. Mean total FR content was c. 30 mg FRs per phone.

"Maternal transfer of environmentally relevant polybrominated diphenyl ethers (PBDEs) produces a diabetic phenotype and disrupts glucoregulatory hormones and hepatic endocannabinoids in adult mouse female offspring", E. Kozlova et al., Nature Scientific Reports 2020 10:18102 <https://doi.org/10.1038/s41598-020-74853-9>

"Trimester-specific effects of maternal exposure to organophosphate flame retardants on offspring size at birth: A prospective cohort study in China", D. Luo et al., J. Hazardous Materials 406 (2021) 124754 <https://doi.org/10.1016/j.jhazmat.2020.124754>

"Distribution of flame retardants in smartphones and identification of current-use organic chemicals including three novel aryl organophosphate esters", Y. Zhang et al., Science of the Total Environment 693 (2019) 133654, <https://doi.org/10.1016/j.scitotenv.2019.133654>

* TPHP = Triphenyl phosphate, TBOEP = tris(2-butoxyethyl)phosphate, EHDPP = 2-ethylhexyl diphenyl phosphate, TEP = triethyl phosphate, TCEP = tris(2-chloroethyl) phosphate, TCIPP = tris(2-chloroisopropyl) phosphate

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