pinfa
Phosphorus, Inorganic & Nitrogen Flame Retardants Association

Your newsletter for non-halogen fire safety solutions n° 184 September 2026

PINFA IN ACTION

Webinar: EU Br-FR substitution hub

Free. 10th September, 14h-14h45 CEST: pinfa's 3rd sparks webinar, with Maria Expósito Delgado, AIMPLAS, presenting the EU-funded HEFESTOS Hub for the Substitution of Brominated Flame Retardants www.hefestoshub.com (see ECHA list of 'Substitution networks and platforms'). The webinar will discuss current EU work on alternatives to brominated flame retardants and will exchange views on how value chain cooperation can forward the transition to safer and more sustainable fire safe materials.

Join pinfa's 3rd sparks webinar: Thur. 10th September, 14h-14h45 (CEST).

Register here: https://x8y9l.mjt.lu/nl3/n4Il18hcGBnIIx3AaBvhiA

Watch pinfa's 1st sparks webinar "Recycling of PIN FR plastics, with Michael Grosshauser, Fraunhofer LBF https://x8y9l.mjt.lu/nl3/lr9_yBqOZ1A2iYKTHX96cg and 2nd sparks webinar "Closing the Loop: Recycling Strategies for Flame Retardant Additives", with Nacho Montesinos Beltrán, AIMPLAS: https://youtu.be/mH6uAYmdvis?si=IkMLVKophemJNm25

Webinar: milligram scale fire testing

Free. 21st October, 17h30-18h30 CEST: pinfa-NA L&L webinar. Fernando Raffan-Montoya, University of Maryland, presenting milligram-scale flame calorimetry for FR screening. Milligram-scale flame calorimetry is a technique that has been developed at the University of Maryland (UMD) for over a decade as a means to screen gas-phase flame retardants, in order to pre-select before engaging larger scale fire performance testing. It has now been benchmarked for a variety of polymers, fabrics, and even battery components. This webinar will present a history of the milligram-scale flame calorimetry apparatus developed, along with a discussion of results from academic-industrial partnership projects. Future ideas for the device will also be presented, along with additional testing capabilities at UMD. Host: Shannon Gainey, pinfa-

NA (Huber). Moderator: Roger Avakian, pinfa-NA (Avakian PolyChem Consulting)

"Present and Future of Milligram-scale Flame Calorimetry: How an Academic Research Project can Benefit the Material Flammability Industry", free pinfa-NA webinar: Wednesday 21st October 2026, 11:30 - 12:30 EDT (USA) = 17h30 - 18h30 CEST (Brussels time). This is pinfa-NA's 24th Lunch and Learn (L&L) webinar.

Registration https://us02web.zoom.us/webinar/register/WN_0vp64JEdRr--BG6EmkEIBQ and watch previous pinfa-NA L&L webinars: https://www.pinfa-na.org/

HI! PLASTICS
INTERNATIONAL SEMINAR
Advanced Plastic Materials

OCT 6 - 7, 2026
VALENCIA - SPAIN

Advanced Plastic Materials Seminar

Aimplas HI!-PLASTICS: challenges and opportunities related to the plastics in mobility, dual-use technologies and energy. Partnered by pinfa with presentations by pinfa member companies Budenheim, Huber, William Blythe, Clariant, Lanxess, and ICL. The need for lighter, stronger, more functional, and more sustainable plastics solutions in strategic sectors such as aerospace, defence, automotive, transport, shipbuilding, electronics, construction and energy is driving intense R&D activity. Collaboration across all links of the value chain is essential to accelerate transfer to the market. Fire resistance of plastics is a key property for advanced plastics, alongside conductive properties, fire resistance, and radar and electromagnetic signature reduction capabilities.

The pinfa General Assembly (for pinfa members) will take place after Hi!-Plastics, in Valencia.

HI!-PLASTICS 2026, International Seminar on Advanced Plastic Materials, Aimplas, Valencia, Spain, 6-7 October 2026
https://www.aimplas.net/conferences/advanced-plastic-materials-seminar-2026/

pinfa-NA renewed leadership, new member

Thor Chemical Group has joined pinfa North America, the third new member in 2026 after JLS and NeoGraf Solutions (see pinfa Newsletters n°s 172 and 182). Thor, an innovative speciality chemical company with sites in 15 countries provides tailored flame retardant solutions for industry needs. Thor is a longstanding member of pinfa Europe and is now expanding its engagement with pinfa North America.

pinfa-NA has renewed its leadership team, electing as Chair Shannon Gainey, J.M. Huber Corporation, and as Vice-Chairs Margaret H. Baumann, Performance Polymers and Additives LLC and representative of JLS, and Carolyn Pressley, Budenheim.

Thor Chemical Group joins pinfa-NA: https://www.pinfa-na.org/news-releases/thor-chemical-group-joins-pinfa-na

pinfa-NA leadership https://www.pinfa-na.org/news-releases/pinfa-na-announces-new-board-leadership-effective-july-1%2C-2026

pinfa-NA at CAMX 2026

Over 100 participants followed pinfa-NA's webinar on sustainable flame retardant additives ahead of CAMX 2026, Composites and Advanced Materials Expo, a leading North American event for the composites and advanced materials industry. pinfa-NA's 26th August webinar on "Sustainable Fire Safety Solutions for Composites" covered flame-retardant technologies for thermoset and thermoplastic composites, including additive selection, fire testing, flame-retardant mechanisms, and non-halogenated approaches, with Ken Averitte of Huber Corporation, Maggie Baumann of Performance Polymers and Additives LLC, and Roger Avakian of Avakian PolyChem Consulting. CAMX organisers have acknowledged this to be an area of growing need in the composites field. pinfa-NA and several member companies are exhibiting at CAMX 2026, 21-24 September 2026, Georgia, providing further opportunities to connect with the composites community and discuss advances in fire safety and sustainable flame-retardant technologies.

CAMX 2026, 21-24 September 2026, Atlanta, Georgia
https://www.thecamx.org/

pinfa position paper: FRs and toys

FRs are not legally required and are not generally used in toys. Unintentional traces of FRs do not generally pose health risks. This pinfa position paper aims to address misconceptions, suggesting that flame retardants are widely used in toys, and respond to some media misinterpretation of reports of traces of FRs.

There are no EU, North America or global regulations which require FRs in toys in general. On the other hand, the EU Toy Safety Regulation 2025/2509 does exclude or set thresholds for potentially harmful chemicals in general. Some regulations (e.g. EN 71-2 or ASTM F963) do require fire safety for certain specific items, such as costumes or electric toys, but manufacturers can achieve this without using FRs.

Traces of FRs found in plastics in toys are generally at levels clearly showing that they have not been deliberately added and probably come from contamination, e.g. from recycled plastics or from processing of plastics for different uses. There is no evidence that these trace levels pose relevant risks to children.

pinfa position paper, June 2026, 3 pages "Trace amounts, clarifying frequent misconceptions: Why PIN Flame Retardants are not intentionally added to most toys" https://www.pinfa.eu/wp-content/uploads/2026/07/pinfa_position-paper_Toys_Final.pdf

REGULATORY

EU consultation on housing simplification

Open to 30th September. pinfa and other stakeholders will input that fire safety harmonisation reduces regulatory complexity. A consumer and industry joint position (co-signed by pinfa) underlines that regulatory simplification for housing can be compatible with safety and sustainability requirements. pinfa's input to the EU public consultation will point to the examples of other sectors where harmonised fire safety requirements across Europe or worldwide facilitate and accelerate design and delivery to markets, documentation and controls and contribute to reduced costs, e.g. electronics (IEC), transport … pinfa also notes that the European Parliament resolution of 10th March calls for reasonable fire safety standards in new dwellings and for better EU coordination to increase fire safety in Member States. Parliament calls that the principle of positive administrative silence should not apply to safety (no reply = administrative authorisation).

"Safety by Design in Europe's Housing Simplification Agenda" https://anec.eu/wp-content/uploads/2026/05/ANEC-SERV-2026-G-030.pdf

"European Parliament resolution of 10 March 2026 on the housing crisis in the European Union with the aim of proposing solutions for decent, sustainable and affordable housing", 2025/2070(INI), P10_TA(2026)0064 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C_202604004

***EU public consultation open to 30th September** "Housing supply and affordability (regulatory simplification)", input = text 4000 characters plus optional document https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/18658-Housing-supply-and-affordability-regulatory-simplification-_en*

EU chemical import/export restriction list

Consultation on update of list of chemicals restricted for import and export adds certain halogenated flame retardants (Regulation 649/2012 , "Prior Informed Consent" PIC)**.** This reflects inclusion of these halogenated FRs in the Stockholm Convention (Persistent Organic Chemicals). Halogenated FRs proposed for addition to Annex V (chemicals banned from export because banned from use in the EU) are Dechlorane Plus, Long and Medium Chain Chlorinated Paraffins. DecaBDE, other PBDEs and Short Chain Chlorinated Paraffins are already included in Annex V of the Regulation. The proposed update to Annex V also exempts from the export ban chemicals where the cited substances are present below limit values specified in other EU regulations, or where exceptional authorisations are allowed for certain uses in the EU under other EU regulations.

EU public consultation, closed 21st August 2026 "Export and import of hazardous chemicals –amendment of Annexes I and V to Regulation (EU) No 649/2012" https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/15913-Export-and-import-of-hazardous-chemicals-amendment-of-Annexes-I-and-V-to-Regulation-EU-No-649-2012_en

FIRE SAFETY

Wang Fuk Court fire enquiry

Official Enquiry says multiple failures, including non-FR scaffold netting, lead to the avoidable death of 168 victims (see pinfa Newsletter n°178). The Wang Fuk fire, Hong Kong, November 2025, destroyed seven blocks of flats, killing 168 people and leaving thousands homeless. The official Enquiry has heard that 91 of the 168 victims died from smoke inhalation, including in flats which were not touched by the fire. The flats were under renovation, and covered in bamboo scaffolding within plastic construction site netting (to prevent falling objects, etc.). The Enquiry heard that the fire probably started in debris on the rooftop, caused by a discarded cigarette from a smoking renovation worker. Tests and evidence presented to the Enquiry concluded that the non-FR netting released 27 times more energy than FR netting, spread the fire with flaming droplets and that the fire would probably have self-extinguished if FR netting had been used. The fire became catastrophic because fire alarms were disarmed, windows were boarded up with flammable foam and smoke penetrated into stairwells hindering escape. Authorities have engaged legal proceedings against companies and individuals involved in the renovation project.

Wang Fuk fire Enquiry public website https://www.ic-wangfukcourtfire.gov.hk/eng/index.html

"Wang Fuk Court tragedy 'completelyavoidable', inquiry counsel says", Hong Kong Standard, 22 June 2026
https://www.thestandard.com.hk/news/article/335260/Wang-Fuk-Court-tragedy-completely-avoidable-inquiry-counsel-says

"First charges laid over deadly Hong Kong fire", BBC News, 10 June 2026
https://www.bbc.com/news/articles/c04yldyezyeo

RESEARCH AND INNOVATION

Gas and solid phase phosphonate FR action

Analysis of P and PO from three different phosphonate FRs neat and on cotton shows gas and solid phase FR behaviours. The phosphonate PIN FRs tested were a classical phosphonate TRI/DPTS*, a triazine derivative 2DTA** (electron-rich) and a carbamoylphosphonate ID*** (electron-poor). Analysis combined standardised fire testing with thermal analysis, molecular beam mass spectrometry and characterisation of evolved gases and residues, under both pyrolytic and oxidative conditions. Volatilisation of P-containing gases, release of PO radicals and char formation varied between the different phosphonates tested between neat FR and FR treated cotton. Conclusions suggest that the electron-rich 2DTA generated significantly more PO radicals (gas phase fire protection effect) under all conditions, whereas TRI/DPTS generated more $HOPO_2$, and PO formation was

inversely correlated release of phosphorus containing gases, and so to char generation (solid phase fire protection effect). At temperatures below 500°C PO / $HOPO_2$ formation from coated cotton can involve condensed-phase and interface processes rather than being related to phosphorus volatisation.

** TRI/DPTS = 1:3 rimethoxysilyl)propyl]diethylenetriamine : Diethylphosphatoethyltriethoxysilane.*

*** 2DTA = a synthesised triazine derivative described in the paper's supplementary material.*

**** ID = a carbamoylphosphonate synthetised from 3-Isocyanatepropyltriethoxysilane and diethyl phosphite.*

See also "Phosphorus FR radical FR mechanism" in pinfa Newsletter n°180.

"In situ elucidation of PO radical formation pathways in phosphonate flame retardants with different P–C linkage motifs", R. Otto et al., Polymer Degradation and Stability (in print)
https://doi.org/10.1016/j.polymdegradstab.2026.112440

Review & perspectives for organo-P PIN FRs

Research and perspectives review of chemistries, applications, performance and developments in organophosphorus PIN FRs, 44 pages, covering 300 publications. The mechanisms of organo-P FRs are detailed (gas phase radical reaction chain, solid phase char formation) and the effects of differing phosphorus oxidation states (see pinfa Newsletters n°s 170, 171, 175). Performance and application benefits of organic compared to inorganic phosphorus PIN FRs are summarised. Various synthesis routes for both organophosphorus FRs are outlined, including polymeric phosphorus FR materials. Application of organo-P PIN FRs in different polymers is outlined, with tables of reference research publication results for testing of different fire performance parameters in each polymer: thermoplastics, polypropylene, polylactic acid, polyamides, PVC, PET,PHAs and P34HB, polystyrene, ABS, polycarbonate, EVA, thermosets, elastomers, epoxies, polyurethanes, polyesters, vinyl resins, natural rubber styrene butadiene rubber, vitrimers. Recent developments cited include DOPO derivates, phosphazene-based and hyperbranched organo-P compounds. Future research directions are expected to centre on ensuring low toxicity, non-migration and reactive phosphorus PIN FRs, sustainable raw materials and bio-based feedstocks.

"Organic phosphorus chemistry for fire-safe polymeric materials: Research progress and future perspectives", K. Selvaraj et al., Progress in Polymer Science 180 (2026) 102152
https://doi.org/10.1016/j.progpolymsci.2026.102152

See also the review of structure and chemistry of phosphorus FRs by Bob Howell in pinfa Newsletter n°183.

P-N-Si PIN FR for non-drip PET fibres

A DOPO – amine - siloxane PIN flame retardant treatment halved burn length and avoided burning drips in PET fabric. The PIN FR was synthesised by the Atherton-Todd reaction, using the well-known PIN FR molecule DOPO (9,10-Dihydro- 9-oxa- 10-phosphaphenanthrene- 10-oxide) with commercially available 3-aminopropyl triethoxysilane (APTES) and with triethylamine, then formulated to a polysiloxane sol. This was applied to PET fabric by dipping-padding-drying. At 15% loading, LOI (limiting oxygen index) was increased from 21.3% (untreated PET) to 26%, vertical flame damage length was reduced to 2.5 cm (untreated PET totally burned) and burning drips were prevented. Fire performance was durable after five wash cycles. The fire performance is attributed to both gas phase action of phosphorus radicals and formation of stable Si-O-Si crosslinked char.

"Synergistic phosphorus-siloxane hybrids for concurrent flame retardancy and anti-dripping of PET fabrics: Mechanistic design and performance optimization", R. Zhang et al., MTLA Materiialia 45 (2026) 102691
https://doi.org/10.1016/j.mtla.2026.102691

See also "PIN FR no-drip fire performance in PA6" in pinfa Newsletter 156.

Reactive P-N-Si FR for polyester elastomer

A complex P-N monomer and a P-siloxane oligomer reacted into polyester achieved UL 94 V-0 (3mm) without dripping. The P-N monomer was synthesised from dimethyl 5-Aminoisophthalate, diphenylphosphinic chloride and the P-siloxane oligomer from dihydroxydiphenylsilane and phenylphosphonic dichloride (the chlorine not being present in the final synthesised molecules). These PIN compounds were reacted into thermoplastic polyester elastomer at a total of 30% loading, increasing LOI from 18% (neat polyester) to over 29%, reducing peak heat release rate by 15% and achieving UL 94 V-0 (3 mm, NR for neat polyester) with no burning drips. Total smoke production was however increased by over +50%. Tensile strength was considerably increased but elongation at break was halved. The fire performance is attributed to a combination of phosphorus gas phase action, phosphorus-silicon synergy enhancing char formation and silica improving char stability.

"Construction of P-N-Si multi-element synergistic flame retardant system in thermoplastic polyester elastomer towards intrinsic fire safety and anti-dripping", Tian et al., Polymer Degradation and Stability 248 (2026) 112061 https://doi.org/10.1016/j.polymdegradstab.2026.112061

PIN upcycling PET with cobalt MOFs

Post-consumer PET was processed to carbon dots then combined with a cobalt MOF, resulting in a PIN FR for PET. The PET was reacted with ethylene glycol then N,N-dimethylformamide, cobalt nitrate and terephthalic acid to generate carbon quantum dots (CQD) with diameter of 2-5 nm then combined with into a cobalt - PET CQD MOF (metal organic framework). This was tested as a PIN FR at in PET. At 0.4% loading, -22% reduction in pHRR (peak heat release rate) compared to neat PET was achieved, -25% reduction in total smoke release and UL 94 V-2 (3 mm), versus NR for neat PET. Tensile strength and elastic modulus were somewhat reduced, whereas elongation at break was increased. The CQD MOF is considered to accelerate compact char formation in fire and to generate a char structure which inhibits release of smoke and of flammable volatiles.

"Upcycling PET waste into CQDs-MOFs composites: A sustainable strategy for synchronously enhanced flame retardancy and toughened PET", Y. Wu et al., Polymer Degradation and Stability 252 (2026) 112273, https://doi.org/10.1016/j.polymdegradstab.2026.112273

See also recycling of post-consumer PET to carbon dot PIN FRs, M. Chaohui et al. in pinfa Newsletter 183.

PUBLISHER INFORMATION

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