pinfa
Phosphorus, Inorganic & Nitrogen Flame Retardants Association

Your newsletter for non-halogen fire safety solutions n° 156 January 2024

EVENTS

US National Week of Flame Retardants

22-25 January 2024, online, SPE (Society of Plastics Engineers) and pinfa-NA. Nine presentations on regulatory developments, fire testing, new PIN flame retardants, improved performance mineral FRs, PIN FR formulations for polycarbonates, intumescents. Question-answer sessions with experts online. With formulation experts, Case Western Reserve University, Imerys, Avient, Paxymer, FRX Polymers, Celestial Materials, .. The 2022 National Week of Flame Retardants attracted over one hundred participants, see pinfa Newsletter n°142.

US National Week of Flame Retardants, 22-25 January 2024, online. SPE with pinfa-NA. Registration and programme:
https://app.swapcard.com/event/national-week-of-flame-retardants-1

EcoFram 2024

ECOFRAM 2024 - call for speakers

Call open to 31. January, for ECOFRAM Valencia, 22-23 May 2024 (Eco-Friendly Flame Retardant Additives and Materials). This 4th international ECOFRAM conference will address fundamental and applied research concerning eco-friendly flame retardant additives and materials. It follows the 3rd ECOFRAM conference, Alès, France, 2022, see summary in pinfa Newsletter n°139.

ECOFRAM, Valencia 22-23 May 2024, 4th International Conference on Eco-Friendly Flame Retardant Additives and Materials
https://www.aimplas.net/plasticsacademy/training-offer/ecofram-2024-international-conference-on-eco-friendly-flame-retardant-additives-and-materials-2/

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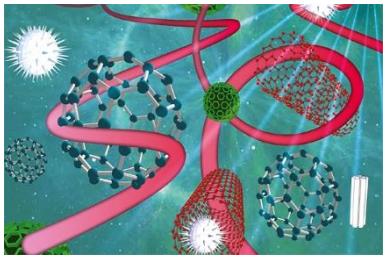
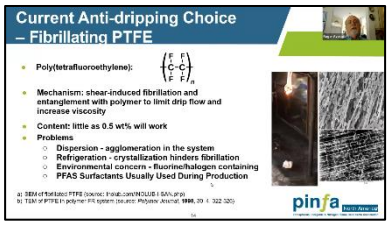


Nanostructured FRs – call for papers

15th February submission deadline for papers for journal Special Issue on Nanostructured FRs and their Applications, in Nano-Structures & Nano-Objects. Articles should address new and efficient flame retardant systems using nano-structured FRs, in particular emergent nanostructured particles such as fullerene, nanodiamond, nano-biobased particles, MXenes, Layered double hydroxide (LDH) nanoparticles, POSS, etc.

https://www.sciencedirect.com/journal/nano-structures-and-nano-objects or contact henri.vahabi@univ-lorraine.fr Image: Elsevier Nano-Structures & Nano-Objects



Non-halogenated anti-drip fire safety

pinfa North America webinar outlines development in non-PFAS drip suppressants for polymer fire safety, with Roger Avakian, polymer formulation expert. In fire, polymers melt and break down to smaller molecules, causing dripping which risks spreading fire to other materials. Therefore, flaming dripping causes failure of fire tests such as UL 94 V-0. Fibrillated PTFE, a PFAS (polyfluoroalkyl substance) is today widely used to prevent melt-dripping, usually at low loading (0.5 – 2%). In heat, the fibrils contract, contracting the polymer and inhibiting melt-dripping. However, given the expected regulatory restriction of PFAS (see pinfa Newsletter n°148), downstream users are actively looking for non-halogenated, non-PFAS fire safety solutions.

Non-halogenated non-drip solutions, for use in combination with PIN flame retardants, are today available in some polymers and are being widely researched. These can act by different mechanisms including increasing polymer melt viscosity (e.g. minerals), creating structural char layers which physically prevent dripping by ceramified or branched char (e.g. silicones, treated minerals, fibrous minerals), or by chemically reacting or catalysing polymer cross-linking in fire (e.g. zinc or boron compounds, carboxylic acids) – or by combinations of these mechanisms. Active research is also underway into other possible solutions such as bio-based or nano-materials (e.g. corn starch, glass flakes …). The webinar outlined each of these different approaches: mode of action, state of development, solutions on the market, and discussed applicability to different polymers.

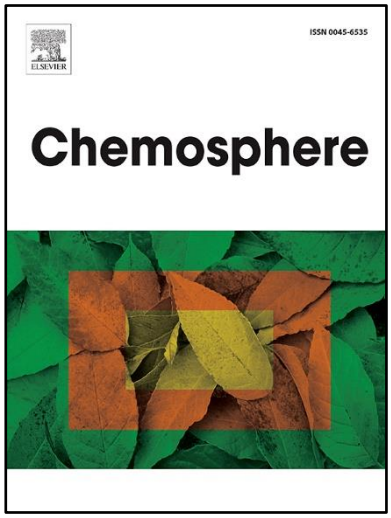
Watch online the pinfa-NA webinar of 6 December 2023 "Drip suppressants: a critical current ingredient and unmet market need" https://www.pinfa-na.org/presented-webinars

POLICY AND REGULATION

US: tighter restrictions for DecaBDE, PIP

US EPA proposes to further restrict DecaBDE (brominated FR) and PIP (TrTPP = phenol, isopropylated, phosphate (3:1)). These flame retardants are PBT (persistent, bioaccumulative, toxic) and are already restricted since 2021 under US TCSA (Toxic Substances Control Act), with bans on production and sale of articles containing the substances, but with some exceptions. The proposed further restrictions would, for DecaBDE: require labelling of existing pallets containing DecaBDE, require use of worker personal protective equipment (PPE) when handling articles containing DecaBDE, ban release to water, modify exceptions for wires and cables for nuclear facilities and extend record keeping requirements. For PIP: modify exclusions for certain specific applications, require engineering controls when processing PIP-containing products and extend record keeping. The proposals are open to comment until 8th January 2024.

US Federal Register / Vol. 88, No. 225 / Friday, November 24, 2023 / Proposed Rules https://www.govinfo.gov/content/pkg/FR-2023-11-24/pdf/2023-25714.pdf



Discussing the ECHA FR Strategy

Discussion paper welcomes the ECHA FR Strategy grouping approach and proposes additional criteria. The paper, by three environmental scientists, suggests that flame retardant use should target applications where FRs bring significant fire safety benefits and where alternative routes to fire safety are not available, citing as examples upholstered furniture as a main cause of fire deaths and injuries, and polymers in electronics which are subject to heat. The paper welcomes the ECHA Flame Retardants Strategy (March 2023, see pinfa Newsletter n°147) and its "grouping" approach as susceptible to prevent regrettable substitution, when one banned individual FR is replaced by a similar one. The paper suggests however that the grouping approach should be extended to also take into account complex toxicity effects (neurotoxicity, endocrine disruption), mobility, impacts on recycling and waste/emissions. The paper notes that difficulties to identify specific brominated FRs in WEEE already lead to exclude from recycling all plastics with total bromine > 2000 mg/kg (CENELEC 50625-3-1).

"The European Regulatory Strategy for flame retardants – The right direction but still a risk of getting lost", J. de Boer, S. Harrad, M. Sharkey, Chemosphere 347 (2024) 140638, https://doi.org/10.1016/j.chemosphere.2023.140638 Paper written with financial contribution from Rockwool.

Balancing fire risk and flame retardants

Paper concludes that lower fire safety standards may be justified in only a few specific furniture types. The UK has the world's strictest fire safety regulations for domestic furniture and these regulations are currently under review (see pinfa Newsletter n°154). This study was requested by the Government as input to this revision. The authors note that open weave fabrics and foams used in furniture are highly flammable and that the flame retardants currently most used are halogenated and suspected of being SVHC (substances of very high concern). This study develops a conceptual risk assessment framework to identify certain types of furniture with a low balance of fire risk, based on literature and expert opinions, where fire safety regulation could be relaxed, so reducing flame retardant use and exposure. Fire risk and exposure were assessed for different types of furniture, different dimensions and different types of furniture. The authors state that "many materials used in furniture are inherently flammable. Until this is addressed, complete elimination of FRs may pose unacceptable fire risks" and identify a few specific clusters of furniture product types for which fire regulation requirements could be relaxed, including baby and infant products and pillows.

"Reconciling chemical flame retardant exposure and fire risk in domestic furniture", P. Whaley et al., 2023, PLoS ONE 18(11): e0293651, https://doi.org/10.1371/journal.pone.0293651

UK Furniture Fire Safety Regulations debate

UK Environmental Audit Committee (EAC) attacks fire safety regulations, flame retardants and Standards Institution. The EAC is a committee of the UK Parliament. Following the public consultation on revision of the UK Furniture Fire Safety Regulations (see pinfa Newsletter n° 152), EAC has published a letter to the Government questioning the approach proposed. EAC suggests that the British Standards Institution (BSI) "could be used by industry to frustrate change and delay reform" and questions the effectiveness of the Regulations to prevent lives and injuries – whereas the Government's consultation document states that the Regulations are recognised as having reduced fire deaths. EAC also calls to exclude SVHC chemicals (substances of very high concern) from furniture. pinfa input to the public consultation supports exclusion of chemicals which jeopardise health safety, based on risk analysis and existing chemical legislation processes (see pinfa Newsletter n° 154).

The UK's firefighters (Fire Brigade Union) have taken position saying that the Regulations save "dozens of lives per year". The firefighters' organisation says that the UK's Furniture Fire Safety Regulations prevent 50 – 70 fire deaths per year, stating that the spread of lithium ion batteries (in laptops, mobile phones, e-cigarettes and other devices) and the new fire risks they bring points to a need for more regulation not less. Contrary to the EAC above, the firefighters consider that the proposed use of BSI standards

would be too weak and not provide adequate regulatory fire protection. The firefighters underline the problem of dense, toxic smoke released by burning polymers, in particular polyurethane foam (see Peck below). They call for banning of flame retardants which are "hazardous to health" and of flame retardants which contribute to smoke toxicity.

"Home furnishings must be made less toxic: EAC writes to Minister to seek clarity on Government plans to ensure the fire safety of furniture", UK Environmental Audit Committee, 1 December 2023
https://committees.parliament.uk/committee/62/environmental-audit-committee/news/198750/home-furnishings-must-be-made-less-toxic-eac-writes-to-minister-to-seek-clarity-on-government-plans-to-ensure-the-fire-safety-of-furniture/

"Scrapping furniture safety regulations will cost dozens oflives a year, warns fire union", UK Fire Brigades Union, 22 December 2023,
https://www.fbu.org.uk/news/2023/12/22/scrapping-furniture-safety-regulations-will-cost-dozens-lives-year-warns-fire-union

FIRE SAFETY

Halloween costumes fire danger

Tests show some children's Halloween outfits ignite within a second and burn for up to ten minutes. 15 UK supermarket Halloween costumes were tested by UK firefighters (Pegswood, Northumberland) with The Sun newspaper. Some ignited within a few seconds and burned completely in flames for minutes. Others melted and dripped. Fire fighters and a consumer group state that there are no fire safety regulations for such costumes. In contradiction to this, supermarkets whose costumes caught fire in 2-6 seconds and burnt for minutes (Aldi, Asda, B&M, Home Bargains, Lidl, Morrisons, Tesco, Wilko) mostly replied to The Sun stating that their costumes were tested and conform to industry or regulatory safety standards.

"Cheap supermarket Halloween costumes go up in flames in as little as one second", The Sun newspaper UK, 15th October 2023
https://www.thesun.co.uk/money/20119519/cheap-supermarket-costumes-burn-just-1-second/

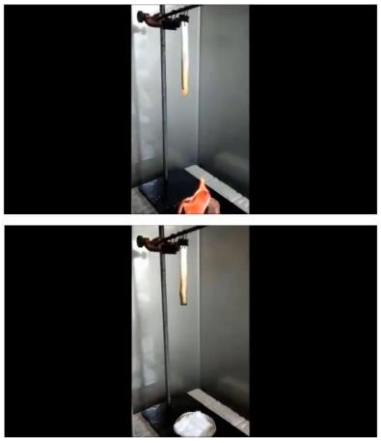
Runway fire: all JAL passengers escape

All 379 people on JAL's Airbus A350 escaped unhurt when it caught fire after crashing into another plane during landing. Reports suggest that the Airbus was landing normally until one wing hit a small Japan coast guard Bombardier Dash-8 which was stationary on the runway waiting to take off. Enquiries are underway to establish why the Bombardier was parked where the Airbus was landing. The crash caused the Airbus to catch fire, probably with fuel involved given the rapid fire. The incident again illustrates how fire safety requirements for aircraft materials can prevent fire spread, despite more than half of modern aircraft structure, as well as seats and interiors, being made of potentially flammable materials.

See also NSTB report on Chicago AA Boeing 767-300 fire in pinfa Newsletter n°86.

Japan Airlines / coast guard plane crash, Haneda airport, 5th January 2024 "How a fiery plane crash at Japan's Haneda Airport unfolded" https://eu.usatoday.com/story/graphics/2024/01/02/japan-coast-guard-plane-crash-graphics/72083108007/

RESEARCH



PIN non-drip solutions without PTFE

Tolsa webinar presents PIN FR synergists to achieve non-drip fire performance in different polymers. In a 30-minute webinar on the SpecialChem material selection platform, Marta Sacristán Benito explains how Tolsa's organo-clay PIN additives can achieve UL 94 V-0 non-drip without using PTFE in a range of polymers (EVA, PP, EPDM, UPS PA, PVC). PTFE is widely used at low loadings (0.5%) to reduce melt-dripping which can spread fire, but which is a PFAS substance with health, environment and regulatory challenges. The Tolsa additives use specific organic molecules to surface-modify natural magnesium silicate clays, so ensuring compatibility with different polymers. The organo-clays stabilise the polymer in fire and enhance char formation, generating a barrier against heat and reducing oxygen penetration and volatile organic emissions, and so reducing melt-dripping, flame spread, heat release and smoke production.

SpecialChem "Webinar: ADINS® Clay additives: A solution to replace the PTFE in flame retardant formulations", November 2023 https://polymer-additives.specialchem.com/webinar-video/replace-the-ptfe-in-flame-retardant-formulations

PIN FR no-drip fire performance in PA6

Hyperbranched polysiloxane (PBDSi) containing P and N shows to be an effective FR in polyamide-6 at only 3% loading. Silica, phosphorus containing DOPO and N containing Schiff-base were combined into one PIN FR oligomeric molecule, PBDSi, by reacting commercially available 3-aminopropyl triethoxysilane (APTES), diphenylsilanediol (DPSD) and DOPO. At 3% loading in polyamide (PA6), LOI (limiting oxygen index) was increased by 30%, peak heat release was reduced by over 30% and melt-dripping was prevented (4mm samples) with only small effects on mechanical properties. The authors suggest that the fire protection mechanisms are generation of a Si-P char layer and release of incombustible gases. This paper shows a potential PIN FR solution to avoid drip without using PTFE anti-drip additive in polyamide.

"A novel phosphorus-nitrogen-based hyperbranched polysiloxane for improving the fire safety of PA6 with suppressed melt droplets and good mechanical properties", S. Fan et al., Heliyon 9 (2023) e22877, https://doi.org/10.1016/j.heliyon.2023.e22877

PIN FRs and polyurethane fire toxicity

Overview of polyurethane fire decomposition, smoke toxicity and potential impacts of PIN FRs on smoke release and toxicity. In-depth review by G. Peck (University of Central Lancashire, UK) summarises fire toxicity and smoke production from polyurethane foams, which are a leading cause of fire injuries and deaths in building fires, with release of hydrogen cyanide, isocyanates, carbon monoxide and other toxic gases. Studies show that decomposition behaviour varies with polyurethane polymer structure, so that specifically adapted FR solutions are needed. Halogenated FRs are not discussed because considered problematic. The detailed discussion of different PIN FRs concludes that a range of mineral, metal, clay and carbon-based PIN FRs and synergists can reduce smoke emission and fire gas toxicity from polyurethanes, as well as reducing heat emission. Although some phosphorus PIN FRs can increase smoke production (gas phase action), other studies (e.g. with DOPO) show significant reductions in release of hydrogen cyanide and other decomposition products. Nitrogen-based PIN FRs are considered to "have potential to form HCN" but the authors indicate that there is no evidence of this occurring and that they have been shown to reduce smoke. Char-forming PIN FRs are considered beneficial because they reduce heat release, smoke production and smoke toxicity.

"The Decomposition of Polyurethane and Fire Retardants: A Review", G. Peck, pre-print https://doi.org/10.20944/preprints202311.1646.v1

PIN FR synergy in recycled ABS

Combining mineral PIN FRs can improve fire performance and reduce smoke without compromising mechanical performance. Recycled ABS was supplied by the EU CREAToR project which is developing a process to remove brominated flame retardants from and then reuse post-consumer and industrial thermoplastic plastic wastes. Four mineral PIN FRs were tested in the rABS, alone or in combinations (total loading 15%): commercially available ATH (aluminium trihydroxide), MDH (magnesium hydroxide), Sepiolite (phyllosilicate-based nanoclay) and one recycled material PAVAL (an aluminium industry waste stream containing a mixture of aluminium minerals). The combination of 7.5% MDH – 7.5% sepiolite reduced total smoke production by 10% and reduced total heat release rate by 50%. Only the samples with sepiolite achieved HB flammability rating (3 mm, no dripping). The combinations of PIN FRs including sepiolite are considered by the authors to not compromise the mechanical performance of the rABS.

"Cooperative Effect of Chemical and Physical Processes for Flame Retardant Additives in Recycled ABS", A. Rodriguez et al., Polymers 2023, 15, 2431, https://doi.org/10.3390/polym15112431

MARKET STUDIES

Flame retardant "market reports"

Market studies, for sale online, continue to predict sustained growth in flame retardants worldwide, but numbers vary widely. Most reports suggest electronics, cables, construction, transport (in particular automobile, aerospace) as key growth sectors, with growth driven by fire safety regulations and industry standards, and by development of synergistic FR systems.

The range in numbers given as estimates for today's global flame retardant market is more than a factor of four. This suggests that possibly these reports, which all claim to cover the world "flame retardant" market, may not be including the same things. Estimates of expected annual market growth (CAGR) also range by a factor of more than four from 2.8% to 11.6%.

If outliers are ignored, most reports suggest that the total world FR market is currently around 7 – 8 bnUS$ with expected growth of maybe around 6% CAGR to 2030.

Estimates for market value of non-halogenated flame retardants are similarly variable. Estimates for market growth of non-halogenated FRs are generally slightly higher than for the total FR market, but given the wide variations it is doubtful whether this is meaningful.

See also summaries of FR market studies in pinfa Newsletters n°143 and 148.

Billion US$	***Growth CAGR***	***Current market***	***To reach***
Global market all FRs (US$)			
Acumen	6.3 %	8.1 bn$ (2022)	14.8 bn$ (2030)
FutureMarketInsights	7.1 %	8.5 bn$ (2022)	17 bn$ (2032)
For comparison: previous report FutureMarketInsights	*5.9%*	*7.5 bn US$ (2020)*	*11.2 bn US$ (2027)*
GrandView	7.1 %	8.6 bn$ (2023)	14.9 bn$ (2032)
For comparison: previous report GrandViewResearch (GVR)	*8.0 %*	*7.5 bn US$ (2020)*	*13.8 bn US$ (2028)*
IMARC	6.6 %	9.2 bn$ (2023)	13.5 bn$ (2030)
MarketResearch Biz	5.1 %	7.2 bn$ (2023)	11.8 bn$ (2033)
MarketResearchFuture	6.9 %	8.1 bn$ (2022)	14.8 bn$(2032)
MarketsAndMarkets	5.2 %	7 bn$(2022)	9.5 bn$(2028)
ReliableResearch	11.6 %	7.7 bn$ (2022)	14 bn$(2030)
Straits Research	4.7 %	7.7 bn$ (2021)	11.7 bn$(2030)
Technavio	4.7%	7.6 bn$ (2022)	9.5 bn$ (2027)
Valuates	2.8 %	6.6 bn$(2022)	8.3 bn$(2029)
Other previous reports			
BrainyInsights	7.3%	8.6 bn US$ (2022)	15.0 bn US$ (2030)

DataBridge	6.2%	12.8 bn US$ (2021)	20.7 bn US$ (2029)
Emergen	5.1%	6.7 bn US$ (2021)	10.5 bn US$ (2030)
ReportLinker	4.5%	15.3 bn US$ (2022)	21.7 bn US$ (2030)
ResearchandMarkets	5.1%	7.2 bn US$ (2022)	9.2 bn US$ (2027)
ResearchandMarkets	*5.9%*	*8.2 bn US$ (2021)*	*13.6 bn US$ (2030)*
MarketResearchGuru	*4.3%*	*3.3 bn US$ (2022)*	*4.3 bn US$ (2028)*
AlliedMarketResearch	*6.6%*	*7.4 bn US$ (2020)*	*14.0 bn US$ (2030)*
MarketsandMarkets	*5.1%*	*7.2 bn US$ (2022)*	*9.2 bn US$ (2027)*
P&SIntelligence	*5.3%*	*7.6 bn US$ (2021)*	*12.0 bn US$ (2030)*
Global market non-halogenated FRs			
Business Research Co	10.5 %	4.8 bn$ (2023)	5.3 bn$ (2032)
Data Bridge	9.1 %	5.8 bn$ (2022)	11.6 bn$ (2030)
MarketResearchFuture	5.7 %	2.2 bn$(2023)	3.4 bn$(2032)
StratView	8.5 %	4.6 bn$(2023)	7 bn$(2028)
Other previous reports			
Zion	8.5%	4.1 bn US$ (2021)	6.8 bn US$ (2028)
CoherentMarketInsights	*6.4%*	*3.0 bn US$ (2019)*	*5.0 bn US$ (2027)*
IndustryArc	*8.0%*	*4.9 bn US$ (2022)*	*7.2 bn US$ (2027)*
VerifiedMarketResearch	*8.6%*	*4.1 bn US$ (2020)*	*7.9 bn US$ (2028)*

PRODUCT INNOVATION

PIN FR compound for battery protection

Syensqo part bio-based long glass fibre PIN FR polyphthalamide for structural, heat, fire and electrical protection of EV batteries. The long fibres create a complex 3D network during injection molding (using standard equipment) ensuring retention of mechanical properties at high temperatures and during demanding operational conditions. Non-halogenated flame retardants ensure UL 94 V-0 (0.8 mm for certain grades). The compound can resist direct flame at 1000°C for more than ten minutes and also high electrical resistance (tracking index > 600V). The compound can replace metal in battery endplates, structures and holders, enabling lightweighting and improving electrical safety, whilst protecting against thermal runaway, fires and mechanical damage. Production of the resin is partly bio-based and uses 100% renewable electricity.

"Solvay Launches New Xencor™ XTreme for Battery Thermal Runaway Protection", 9 October 2023. Solvay is now Syensqo:
https://www.solvay.com/en/press-release/solvay-launches-new-xencor-xtreme-battery-thermal-runaway-protection

PIN FR for railway wool textiles

Camira launches non-halogenated flame retardant treatment for wool fabrics for public transport applications. The treatment can achieve the EU railway standard strictest heat, smoke release and smoke toxicity criteria (EN 45545(R21)-HL3) by enhancing wool's natural fire resistance, which results from its moisture and nitrogen content. By enhancing charring, the treatment slows burning and minimising smoke release. Wet bath application reduces water and energy use, CO_2 and ammonia emissions and provides a durable, wear resistant treatment.

"Taking the halogens out of flame retardants", Railway Gazette, 7th August 2023 https://www.railwaygazette.com/technology/taking-the-halogens-out-of-flame-retardants/64637.article and Camira 25th July 2023 "Nitrophlam: An environmentally conscious flame retardant treatment" https://www.camirafabrics.com/en-uk/transport/news-events/introducing-nitrophlam

Performance PIN FR polyamides for EVs

Celanese offers two non-halogenated flame retardant polyamide solutions for e-mobility power chains and batteries. PIN FR polyamide 66 compounds achieving UL 94 V-0 (1.5 mm) are adapted for thick-walled components and parts for batteries. Flow characteristics, including with e.g. 30% glass fibre, enable more flexible component design and efficient production. Electrical insulation (high tracking index) and colour are maintained after ageing. PIN FR polyamide achieving UL 94 HB with extremely low halide content maintains tracking index CTI > 600V even after 125°C ageing for 3 000 hours. It is adapted for use in electrical components such as connectors, switches, relays, busbars and sensors, in which halide corrosion must be prevented, to avoid short circuits or dysfunctions.

"Celanese Launches New PA Solutions to Improve Performance of Electric Vehicle Components", 16 October 2023 https://www.celanese.com/news-and-media/2023/october/celanese-new-pa-solutions-to-improve-performance-of-ev-components

Fire resistant PIN polyamide for EVs

Ascend Performance Materials' PIN FR PA66 resistant to 1100°C flame for 15 minutes for electric vehicle battery safety. The non-halogenated flame retardant performance polymer offers fire protection performance to SAE AS5127 (aerospace specification), better than aluminium, and will contribute to ensuring passenger safety in case of battery failure and thermal runaway. The PIN polyamide also offers mechanical integrity at 350°C, improved abrasion resistance, ultrasonic weld line strength, UL 94 V-0 @ 0.8 mm, glow wire GWFI 960°C and EN 45545 (railway specifications) rating R22: HL3. The material can be glass-fibre reinforced, brightly coloured and can be injection moulded using standard polyamide processing equipment. In June 2023, Ascend indicated that with its fire performance and vibration damping compounds, the company

sells 25-30% more material into electric vehicles than internal combustion vehicles.

"New materials create safer, quieter EVs", PRN 13/10/2022 https://www.prnewswire.com/news-releases/new-materials-create-safer-quieter-evs-301647886.html and Ascend Starflam-X pages https://www.ascendmaterials.com/products/our-brands/starflam/starflam-x-protect/

LSZH for replacing halogenated cables

SUNUA Low Smoke Zero Halogen cross-linked polyolefin cable insulation compounds offer performance and processing. The PIN flame retardant compounds can be cross-linked by UV irradiation up to sheath thickness of 1.6 mm maximum, to improve strength and mechanical properties (low-cracking, tensile strength, thermal elongation, low temperature brittleness). The compounds can be suitable for cable core operating temperatures up to 125°C, higher than for thermoplastic cable insulation compound. Smoke densities are below 335 / 94 for flameless/flame under GB/T8323. The compounds target B-end customers (focus on specific needs of customer companies) and applications include public buildings such as schools and hospitals and public transport where safety by low smoke emission and low smoke toxicity is required.

"SUNUA Halogen-Free Flame Retardant: Elevating Cable Material Excellence", 30th August 2023 https://www.sunualszh.com/news/sunua-halogen-free-flame-retardant-elevating-cable-material-excellence.html

Huber LCAs for PIN FRs

Huber Advanced Materials has announced completion of Life Cycle Analyses for 90% of its products, including mineral PIN FRs (aluminium hydroxides, calcined aluminas, activated aluminas and magnesium hydroxides). The LCAs are available on request to customers to support their sustainability actions, and updates will be also transmitted to customers. Huber's sustainability ongoing projects include natural gas cogeneration at its Martinswerk site Germany and photovoltaics at its Illinois US site. Huber achieved Ecovadis silver rating for sustainability 2023 and Deloitte US best managed company gold standard.

"Huber Advanced Materials Achieves Sustainability Milestone Through Completion of Life Cycle Analyses for Major Product Portfolio", 13 December 2023 https://polymer-additives.specialchem.com/news/industry-news/huber-advanced-materials-lca-entire-product-portfolio-000232778

PUBLISHER INFORMATION

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