pinfa
Phosphorus, Inorganic & Nitrogen Flame Retardants Association

Your newsletter for non-halogen fire safety solutions n° 136 April 2022

SUSTAINABILITY CRITERIA

TCO Generation9 targets safer chemicals

Updated certification for IT equipment again restricts halogenated substances and authorises safer PIN FRs. The TCO Certified Generation9, the health, environment and worker protection label for office and home electronics, is updated to further address sustainability of raw material supply, circularity and lifetime extension, as well as now covering chemicals used in IT manufacture (not only chemicals present in the final product). The updated criteria exclude all halogenated FRs in some parts (e.g. housing parts and power PCB for displays, computers, etc.), excludes certain brominated FRs from all parts (PBB, PBDE, HBCDD) and specifically authorises PN FRs which have been independently assessed as safer alternatives (by GreenSreen® score 2, 3 or 4). Twenty-two PIN FRs are thus currently authorised by TCO as "Accepted Safer Substances" including FRs based on phosphorus, melamine, ammonium, aluminium, magnesium and siloxane/silicone.

"Updated criteria give purchasers more influence in the IT supply chain", TCO, 23 February 2022 https://tcocertified.com/news/updated-criteria-give-purchasers-more-influence-in-the-it-supply-chain

TCO Certified criteria documents https://tcocertified.com/criteria-documents/

"Safer alternatives to hazardous substances", "TCO Certified Accepted Substance List" https://tcocertified.com/industry/accepted-substance-list/

EU court confirms halogenated FR ban

The European General Court has validated the EU Ecodesign Regulation ban on halogenated FRs in TV and monitor cases. The Court has dismissed a challenge brought by BSEF, an industry group whose members are four companies manufacturing brominated flame retardants FRs (Br-FRs). The EU Ecodesign Regulation 2019/2021, applicable since March 2021, bans halogenated flame retardants in the enclosure and stand of all TVs and electronic displays > 100 cm^2 sold in Europe (see pinfa Newsletter n°108).The Court rejected the suggestion that all brominated FRs cannot be banned using the Ecodesign Regulation because other EU regulations might be more appropriate (e.g. RoHS, REACH). The Court concludes that the ban of all Br-FRs in parts of TVs and monitors is not contradictory with wider restrictions of specific Br-FRs in all electronic equipment under RoHS. The Court also judges that the Commission engaged necessary prior consultations and took sufficient account of relevant information in deciding this Ecodesign ban on all halogenated FRs (as applicable), that it is legally valid to ban all halogenated FRs as a group, that this ban as applicable is "proportionate" given the objective of increasing the recycling rate for plastics in electronics components.

"EU court dismisses challenge to ban on sales of TVs with halogenated flame retardants", Chemical & Engineering News, 23 March 2022 https://cen.acs.org/policy/litigation/EU-court-dismisses-challenge-ban/100/web/2022/03

CURIA Case Law: European General Court (8th Chamber), case T-113/20, 16 March 2022 "Energy – Directive 2009/125/EC – Ecodesign requirements for electronic displays – Regulation (EU) 2019/2021 – Ban on halogenated flame retardants in the enclosure and stand of electronic displays – Competence of the author of the act – Manifest error of assessment – Legal certainty – Proportionality – Equal treatment)", BSEF v. European Commission" https://curia.europa.eu/juris/document/document.jsf?docid=256004

REGULATORY AND CONSULTATIONS


EUROPEAN COMMISSION

Brussels, 30.3.2022
COM(2022) 144 final
2022/0094 (COD)

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

laying down harmonised conditions for the marketing of construction products, amending Regulation (EU) 2019/1020 and repealing Regulation (EU) 305/2011

Proposed regulatory text for update of CPR

To 1st June. The EU has published for comment the proposed text of the revised Construction Products Regulation (CPR). pinfa already made input during the preparatory phases, see pinfa Newsletter n°21. The revision of the CPR aims to address implementation and single market issues with the current regulation, to promote environmental Green Deal goals and to "*possibly promote product safety*". pinfa will provide analysis of the new regulation proposed text and outline input in our next Newsletter.

*EU public consultation **open to 1st June 2022**. "Construction products – review of EU rules". Any member of the public, company or organisation can input a 4000 character comment and/or a position or proposal document (max. 5 Mo). https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12458-Construction-products-review-of-EU-rules_en*


JRC SCIENCE FOR POLICY REPORT

Best Available Techniques (BAT) Reference Document for the Textiles Industry

Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control)

JOINT RESEARCH CENTRE
Directorate B – Growth and Innovation
Circular Economy and Industrial Leadership Unit
European IPPC Bureau

Final Draft (March 2022)

EU textiles industry BAT regulatory update

Draft update to BAT will require consideration of substitution of brominated flame retardants for textiles finishing. Under the Industrial Emissions Directive (IED), EU Best Available Techniques (BAT) specifications, where defined, are legally applicable to all concerned industry installations in Europe. pinfa made detailed input to the process of updating the textiles industry BAT reference document (BREF) in 2020 (see pinfa Newsletter n°114). The current BREF dates from 2003. The updated textiles industry BAT BREF, which is expected to be adopted at the IED Forum in May 2022, now includes a new requirement (BAT 50) that flame retardants used for finishing be selected considering associated risks, in particular of persistence and toxicity, and "*potential for substitution (e.g. of brominated flame retardants)*" and (BAT 14) that a Chemical Management System (as part of EMS) be in place for the whole textile process including regular analysis of potential for substitution of "*safer alternatives to the use of (groups of) hazardous substances and substances of very high concern, such as PFAS, phthalates, brominated flame retardants, chromium-(VI)-containing substances*". The proposed update also requires (BAT 7) monitoring of emissions to water of brominated FRs, (BAT 14) waste water treatment to remove organophosphorus and brominated FRs and (BAT 30) separate collection of wastes containing hazardous or of-concern organophosphorus or brominated FRs.

EU IED BAT reference documents (JRC – IPPC Bureau)
https://eippcb.jrc.ec.europa.eu/reference/

March 2022 draft updated Textiles Industry BAT Reference Document
https://eippcb.jrc.ec.europa.eu/sites/default/files/2022-03/TXT_Final_draft_B-W.pdf

Expert Group on the exchange of information on Best Available Techniques related to industrial emissions (IED Article 13 Forum)
https://ec.europa.eu/transparency/expert-groups-register/screen/expert-groups/consult?do=groupDetail.groupDetail&groupID=2611

European Commission

Have your say

EU consultation: chemicals information

To 12th April. Proposals to coordinate different chemicals assessment procedures and improve chemical data access. As part of the EU Chemicals Strategy for Sustainability, the Commission proposes to streamline chemicals assessments by various EU agencies (chemicals ECHA, food safety EFSA, environment EEA and medicines EMA) as well as EU expert groups, scientific committees and contractor studies. It is also proposed to establish an EU repository of human and environmental health-based limit values, and an open-data platform on chemicals.

*EU public consultation, **open to 12th April 2022** "Chemicals – making best use of EU agencies to streamline scientific assessments"*
https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13161-Chemicals-making-best-use-of-EU-agencies-to-streamline-scientific-assessments_en

Reminder: EU consultation on REACH

To 15th April 2022: polymers, endocrine disruption, mixture effects, environmental footprint, essential use. See pinfa Newsletter n°133.

EU public consultation open to 15th April 2022 "Chemicals legislation – revision of REACH Regulation to help achieve a toxic-free environment" https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12959-Chemicals-legislation-revision-of-REACH-Regulation-to-help-achieve-a-toxic-free-environment/public-consultation_en

Canada assessment of 1-bromopropane

Canada has proposed to classify the non-FR chemical 1-bromopropane (nPB) persistent, health and environment risk. 1-bromopropane is principally used as a solvent, degreaser or intermediate in chemicals production, adhesives and sealants, not as a flame retardant. The Canada Government's published draft assessment of 1-bromopropane proposes to classify the substance as health and environment risk (section 64 of CEPA, the Canadian Environmental Protection Act) because of developmental toxicity risk related to use in silicone mold release sprays, electronic cleaners and automotive A/C flush, that is uses not related to flame retardancy. The draft assessment concludes that three other alkyl halides do not meet CEPA $64 criteria (bromoethane, chloroethane, trans-1,2-dichloroethene). The draft assessment is open to public comment for 60 days from 5th march 2022.

*"Draft screening assessment - Alkyl halides Group", Canada Government, March 2022 https://www.canada.ca/en/environment-climate-change/services/evaluating-existing-substances/draft-screening-assessment-alkyl-halides-group.html and "Alkyl Halides Group" webpage https://www.canada.ca/en/health-canada/services/chemical-substances/chemicals-management-plan-3-substances/alkyl-halides-group.html Public comment period: **open for 60 days from 5th March 2022**.(links as above).*

EU public consultation: Toy Safety Directive

To 25th May 2022. Should rules on chemicals in toys should be stricter? Which chemicals should be targeted or banned? The consultation questionnaire, open to the public and to stakeholders, asks whether rules on chemicals in toys should be made stricter, what types of chemical risks should be targeted, how the Directive should address hazardous chemicals and how chemicals should be indicated on toy labels. Other questions address market impacts, cybersecurity, conformity assessment and compliance verification, and whether or not the Toy Safety Directive should be converted into a Regulation (applicable across the EU without national 'transposition').

*EU public consultation, **open to 25 May 2022** "Protecting children from unsafe toys and strengthening the Single Market – revision of the Toy Safety Directive" https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13164-Protecting-children-from-unsafe-toys-and-strengthening-the-Single-Market-revision-of-the-Toy-Safety-Directive/public-consultation_en*

EU public consultation: RoHS review

To 2nd June 2022. RoHS and recycling, Critical Raw materials, REACH. Process for updating restricted substances. The RoHS Directive (Restriction of Hazardous Substances in Electrical and Electronic Equipment 2011/65/EU) is currently under review. The open consultation targets both the general public, with four questions concerning RoHS and recycling (hazardous substances in recycled materials, recycling costs) and 30 questions for industry and specialists. These address regulatory and administrative aspects, scope and exemptions, compliance and market surveillance (including online EEE sales), criteria for allowing restricted substances in EEE recycling, Critical Raw Materials in EEE, process for the review and amendment of the RoHS list of restricted substances, coherence between RoHS and POPs (Persistent Organic Pollutants) regulation for certain brominated flame retardants (PBDEs).

*EU public consultation, **open to 2 June 2022** "Review: Restriction of the use of hazardous substances in electronics"*
https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13137-Review-Restriction-of-the-use-of-hazardous-substances-in-electronics_en

This follows the EU consultation on the roadmap for the RoHS review ("call for evidence") closed 14th March 2022, see pinfa Newsletter n°135

Debate on EPA risk conclusions on HBCD

US EPA's conclusion on risks of the brominated FR, HBCD, faces questions on "whole-chemical" approach.. The EPA's final Risk Assessment of hexabromocyclododecane and the cyclic aliphatic bromide cluster (HBCD), December 2021, see pinfa Newsletter n°135, concludes impacts on aquatic plants, fish embryos, aquatic invertebrates, earthworms and priority human health impact on the thyroid hormone. The American Chemical Council has filed comments objecting to the "whole chemical approach" used instead of "condition-of-use-specific" risk determinations. Environmental associations, on the other hand, consider that the "whole chemical" approach respects the wording of the law (TCSA) which refers to "chemical substance". This "whole chemical" approach is now being applied to revise EPA decisions on a number of chemicals.

"ACC Calls for EPA To Reconsider Its Misguided "Whole Chemical Approach" and Assumptions about PPE", 4th March 2022
https://www.americanchemistry.com/chemistry-in-america/news-trends/press-release/2022/acc-calls-for-epa-to-reconsider-its-misguided-whole-chemical-approach-and-assumptions-about-ppe

FIRE SAFETY

US' grim sequels to Grenfell

Two recent fires in public housing in the US, leaving 29 dead lead to calls for reform in fire safety regulations and funding.17 people died in the Twin Parks North West public housing building, in the Bronx, New York on 13th January, all killed by smoke because automatic fire doors failed to close. The failures of the fire doors had been repeatedly flagged by inspectors over recent years. 12 people died on 5th January in Fairmont in a building managed by Philadelphia Housing Authority. In this case, the victims were all in one duplex flat, which housed 14, whereas according to standards it should only have housed 8. Also, smoke detectors and carbon monoxide detectors in the flat appear to have been non-operational. Philadelphia's chief firefighter called the fire deaths the result of a broken system. These two fire catastrophes in public housing for low-income families are leading to calls for fire safety obligations for housing receiving federal subsidies, including heat sensors and automatic shutoff systems on space heaters, hard-wired (not battery) smoke alarms, self-closing doors and stronger inspection requirements

See also pinfa Newsletter n°133

Archinect "America's Public Housing is Burning, Fueled by Cold Indifference", 9 March 2022 https://archinect.com/features/article/150299164/america-s-public-housing-is-burning-fueled-by-cold-indifference and "Lawmakers are pushing for change in the wake of last month's deadly Twin Parks Fire as residents look to rebuild", 10 February 2022 https://archinect.com/news/article/150298256/lawmakers-are-pushing-for-change-in-the-wake-of-last-month-s-deadly-twin-parks-fire-as-residents-look-to-rebuild#CommentsAnchor

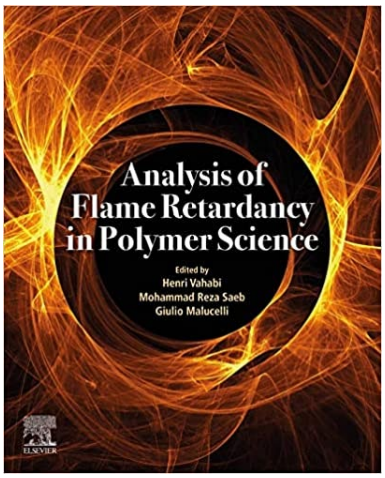
Governing.com "Recent Public Housing Fires Are a Wake-Up Call for Reform", 24th January 2022 https://www.governing.com/now/recent-public-housing-fires-are-a-wake-up-call-for-reform

Increasing threat of wildfires

UNEP predicts global increase of extreme wildfires and recommends ecosystem management and asset protection. Uncontrollable wildfires will increase, even in regions previously unaffected, because of climate change, land-use and population change, resulting in significant climate emissions, particulates and toxic smoke. Recommendations include preparation and awareness, ecosystem management and restoration to limit fuel for wildfires, international cooperation, supporting local communities, improving firefighter safety including reducing smoke inhalation and assessing potential impacts on property and infrastructure to protect assets.

"Spreading like Wildfire: The Rising Threat of Extraordinary Landscape Fires", United Nations Environment Programme, 23 February 2022 https://www.unep.org/resources/report/spreading-wildfire-rising-threat-extraordinary-landscape-fires

PUBLICATION



Flame Retardancy Polymer Science

New 470-page book on fire analysis principles and applications inc. flame retardancy, toxicity, standards and regulations. Addresses techniques for characterisation of fire and flame behaviour and smoke toxicity, laboratory testing techniques, industrial aspects of fire analysis. Covers ignition, burning, pyrolysis, forced combustion, smoke and toxicity analysis, char residue analysis and materials fire resistance. Specific cases considered include fire behaviour of PMMA poly(methyl methacrylate), electric cables and cable tray fires, wildfires, building materials, E&E and transport applications.

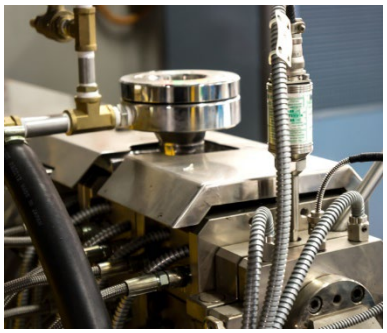
"Analysis of Flame Retardancy In Polymer Science", H. Vahabi, M. Saeb, G. Malucelli, 2022 ISBN: 9780128242612 and 9780128240458
https://www.elsevier.com/books/analysis-of-flame-retardancy-in-polymer-science/vahabi/978-0-12-824045-8

RECYCLING

Growth in chemical plastics recycling

Industry experts AMI expect fast growth in chemical plastics recycling to complement mechanical recycling. Plastics use and waste, especially in packaging, continues to grow, even in Europe. Mechanical recycling capacity is insufficient. Plastic use and waste per inhabitant increased nearly 25% in Europe 2009-2019, with some 30 million tonnes of plastic waste produced of which only 41% recycled by 2021. Investment in chemical recycling capacity is expected to increase from 2.6 billion € 2025 to 7.2 billion € in 2030, resulting in chemical recycling of maybe 10% of plastic waste. The AMI special industry summary "Chemical Recycling. Global Insight 2022" outlines the different types of chemical plastics recycling process (solvent dissolution = polymer recovery, depolymerisation = monomer recovery and thermal cracking = pyrolysis or gasification), and presents leading companies and developments in each technology worldwide. Mixed polyolefins can be recycled by pyrolysis, but presence of halogenated flame retardants or oxygen-rich polymers excludes pyrolysis. More specific dissolution or depolymerisation technologies will be needed for PET or polystyrene. AMI conclude that chemical recycling is adapted for non-homogenous plastics waste streams, but nonetheless does require sorted streams, and that competition with mechanical recycling for plastic feedstock streams is unlikely to be significant.

AMI "Chemical Recycling. Global Insight 2022"
https://content.yudu.com/web/1rl19/0A44ate/CRGIDecember2021/index.html

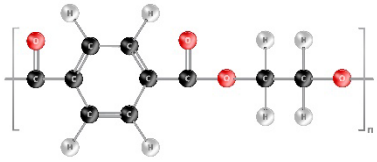


Mechanical recycling of PIN FR polymers

A TU Darmstadt thesis suggests that PIN FRs are not an obstacle to mechanical recycling of thermoplastics. Mineral, nitrogen and phosphorus based PIN flame retardants (ATH, sepiolite, aluminium diethylphosphinate, piperazine pyrophosphate, phosphate ester, APP, melamine cyanurate) were tested in various thermoplastics: polypropylene, polyethylene, polyester, polycarbonate/ABS blend, including with glass fibres and stabilisers. Material deterioration with multiple recycling (five extrusion cycles) showed to be principally related to the base polymer properties, and to shortening of glass fibres, rather than to the PIN FR used, and deterioration of fire performance to damage of anti-drip agents. In PA6 with melamine cyanurate, it was shown that use of a chain-extension additive (maleic anhydride) during re-extrusion significantly reduced polymer property deterioration.

See also summary of Fraunhofer LBF tests of mechanical recycling of PIN FR polymers (project with pinfa) in pinfa Newsletter n°105.

"Recycling von halogenfrei flammgeschützten Kunststoffen" (Recycling of halogen-free flame retardant plastics), Technische Universität Darmstadt thesis, Christoph Schultheis, 2021 https://tuprints.ulb.tu-darmstadt.de/18626/1/Dissertation_ChristophSchultheis.pdf



Phosphorus PIN FR improves PET recycling

Two phosphorus PIN FRs show to protect polymer properties in recycling (multiple re-extrusion cycles) of PET. Poly(ethylene terephthalate) (PET), a polymer widely used for films and textiles, was tested pure and flame retarded with DOPO-PEPA (5%) or with a phosphate ester (3%). Three re-extrusion cycles were carried out. The DOPO-PEPA containing PET showed less deterioration of material properties than pure PET after mechanical recycling, attributed to DOPO-PEPA improving lubrification and melt properties (stabilisation). The phosphate ester however led to embrittlement of the PET after mechanical recycling, probably by boosting polymer chain branching and extension.

"Investigating thermomechanical recycling of poly(ethylene terephthalate) containing phosphorus flame retardants", C. Bascucci et al., Polymer Degradation and Stability, vol. 195, January 2022, 109783 https://doi.org/10.1016/j.polymdegradstab.2021.109783

"Enhanced PET processing with organophosphorus additive: Flame retardant products with added-value for recycling", A. Gooneie et al., Polymer Degradation and Stability 160 (2019) 218e228 https://doi.org/10.1016/j.polymdegradstab.2018.12.028

FRs and solvent chemical recycling

Different solvents were tested for chemical recycling of mixed E&E waste showing recovery of polymers and removal of FRs. Mixed, shredded E&E plastic waste was provided by a commercial waste recycler in the USA, after mill beating and metal separation. This waste contained 6 – 12% phosphorus (P) and 1 – 6% bromine (Br), presumed to be in flame retardants. Eleven different solvents were tested for polymer dissolution, then dichloromethane (DCM), tetrahydrofuran (THF), methanol (MeOH) and ethylene glycol (EG) selected for further testing. Various anti-solvents were tested to precipitate and recover the polymers from solution. Depending on polymer and on the solvents/anti-solvent combinations, up to 99% of polymer was recovered from the wastes. The optimum solvent/antisolvent combination (methanol / ethylene glycol) removed up to 94% of phosphorus flame retardants (based on measurement of phosphorus contents), resulting in low levels in the recovered polymer, whereas removal of brominated FRs was ineffective, leaving 3 – 4% bromine in the recovered polymer.

"Chemical Recycling of Mixed Plastics in Electronic Waste Using Solvent-Based Processing", L. Anderson et al., Processes 2022, 10, 66.
https://doi.org/10.3390/pr10010066

Halogenated FRs in China recycled plastics

Based on measurements in plastics samples, tonnages of halogenated FRs in recycled plastics in China were estimated. Total levels of twelve halogenated flame retardants (HFRs)* were measured in 23 samples of recycled plastics, manufactured in five Chinese provinces. Mean total HFR concentrations were approx. 4 – 60 µg/kg for different recycled polymers tested**. For 2014, this resulted in estimates of total c. 3 000 t/y of HFRs in recycled plastics in China. This was around ten times lower than an estimate based on plastics production for the same year (20% of plastics produced estimated to be flame retardant, 250 000 tonnes of FRs used in plastics in China, of which c. 50% halogenated, around 30% plastics recycling). The authors suggest that the difference may result from migration out of plastics during use or recycling. pinfa suggests that the difference may also result from a lower recycling rate for FR plastics (e.g. compared to packaging plastics which are generally not FR).

** PBDEs, DecaBDE, BTBPE = 1,2-bis(2,4,6-tribromophenoxy)ethane and dechlorane plus isomers. **: PVC, polypropylene, ABS, polystyrene and polyethylene.*

"The non-negligible environmental risk of recycling halogenated flame retardants associated with plastic regeneration in China", Z. Cao et al., Science of the Total Environment 646 (2019) 1090–1096
https://doi.org/10.1016/j.scitotenv.2018.07.373

PIN compounds to recycle polyurethanes

Phosphorus, nitrogen and inorganics used in polyurethane chemical recycling produce PIN flame retardant recycled PUR. Glycolysis is the most widespread route for chemical recycling of polyurethanes (PUR). Glycols or glycerol (which can be bio-derived), with catalysts, are used as depolymerising agents (usually at around 180 to 240°C). This breaks chemical bonds, converting PUR polymers to oligomers (ended by hydroxyl and amine moieties) and breaking crosslinking. Seven studies are summarised which show that PIN compounds, phosphate esters or nitrogen-mineral (urea-boron) containing polyol, can be used for glycolysis of PUR then production of a PIN FR recycled PUR. Other studies show that glycolyzed PET poly(ethylene terephthalate) plastic waste can also be recycled to PIN flame retardant polyurethane (PUR).

"Materials and Chemistry of Flame-Retardant Polyurethanes", Volume 1: A Fundamental Approach, 2021, ed. K. Gupta https://pubs.acs.org/doi/10.1021/bk-2021-1399 chapter 12, pages 265-284, "Recycling of Polyurethanes Containing Flame-Retardants and Polymer Waste Transformed into Flame-Retarded Polyurethanes", M. Włoch https://doi.org/10.1021/bk-2021-1399.ch012

PIN FR recycled denim fire blocks

Denim cotton fabric can be recycled using PIN flame retardants to produce composite boards for fire compartmentation. The world produces some 150 million t/y of textile waste. This review suggests that end-of-life denim cotton fibres treated with PIN flame retardants (such phosphorus-based compounds, nano-coatings or borates) can be used to produce structural boards suitable for use as fire-resistant barriers (fire compartmentation). pinfa notes FRs are important to ensure fire safety of recycled organic materials used in construction. See e.g. pinfa Newsletter n°38: recycled denim based material used for insulation caused fire spread, resulting in 6 million US$ damage to an industrial building in Wisconsin in 2014

"Development of fire retarding composite board for fire compartmentation application using waste denim: A review", Aman et al., Materials Today Proceedings 2022 https://doi.org/10.1016/j.matpr.2021.12.513

INNOVATION

UV cured PIN FR coating

Texas A&M scientists propose phosphorus-based one-dip UV cured fire protective coatings for wood and other materials. The new coating presented at the ACS (American Chemical Society) conference uses an aqueous solution of hydroxyethyl methacrylate phosphate (HMP) monomer, polyethylenimine (PEI) polymer and a the photoinitiator TPO. After dipping wood, UV light is used to change the polarity of HMP, so causing a reaction with PEI with

covalent bonds, generating a micromillimetre protective coating which is shown to reduce heat release, generate char and protect the underlying wood from fire.

"Making wooden construction materials fire-resistant with an eco-friendly coating", ACS, 22 March 2022
https://www.acs.org/content/acs/en/pressroom/newsreleases/2022/march/making-wooden-construction-materials-fire-resistant-with-eco-friendly-coating-video.html and video
https://www.youtube.com/watch?v=JPQi3WyY0rw

Image credit: Ethan Iverson

Polyphosphonate obtains GreenScreen®

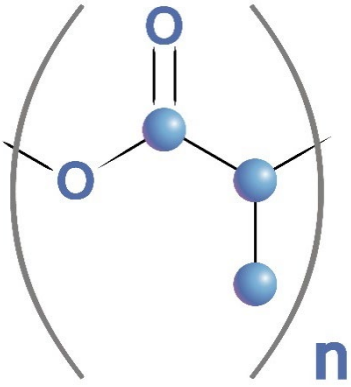
pinfa member FRX Polymers' polymeric phosphorus PIN FR GreenScreen 3 Benchmark recognises safety and non-toxicity. GreenScreen is a leading ESG (Environmental, Social, and Governance criteria), referenced by mainstream labelling organisations, for example the TCO label (see above). Twenty-two PIN FRs are today recognised as safer alternatives by TCO, following GreenScreen benchmarking. The polymeric polyphosphonate PIN FRs now GreenScreen benchmarked join FRX Polymers' copolymer grades already benchmarked. They offer mechanical performance and aesthetic properties, as well as high flow for demanding molding or extrusion processes.

"FRX Polymers' Flame Retardants Granted a GreenScreen Benchmark 3 Score for Electronic Devices", 16 March 2022
https://www.ptonline.com/news/frx-polymers-flame-retardants-granted-a-greenscreen-benchmark-3-score-for-electronic-devices

PIN FR Fabric-over-Foam EMI gaskets

Laird (Dupont group) offers non-halogenated flame retardant EMI (electromagnetic interference) gaskets. With roots back to 1824, and after acquisitions including Emerson & Cuming, BMI, Steward, and Thermagon, Laird Performance Materials is today part of Dupont and specialises in materials for protection of electronic devices from harmful heat and disruptive electromagnetic interference. The company's FOF (Fabric-over-Foam) gaskets, consisting of an electrically conductive fabric (e.g. nickel and copper loaded nylon) around a specifically formulated polyurethane core, provide electromagnetic shielding for applications requiring low compression force, high conductivity and superior shielding. The phosphorus PIN FR FOF gaskets achieve UL 94 V-0 fire performance and are available in various profiles and can be customised by die-cutting, punching etc.

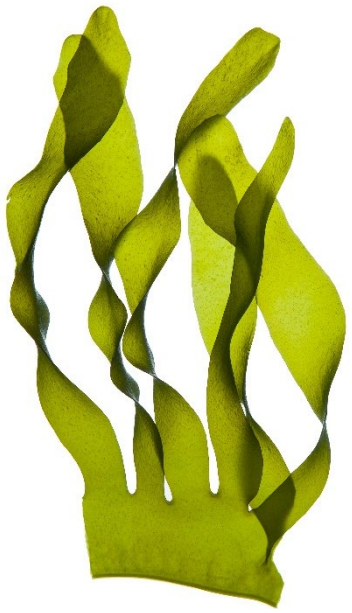
Laird "Flame Retardant (FR) EcoGreen. Fabric-over-Foam (FOF) Gaskets" https://www.laird.com/products/enclosure-solutions/fabric-over-foam-fof-gaskets/flame-retardant-fr-ecogreen



Silicon phosphorus nitrogen FR for PLA

A silicon polyphosphoramide was synthesised and tested as a PIN flame retardant for bio-based polylactide plastic. The commercially available chemicals dimethyl methylphosphonate (DMMP) and 1, 3-Bis(3-aminopropyl) tetramethyl-disloxane (BATDMS) were one-step reacted without solvent, to produce an experimental polymeric silicon – phosphorus – nitrogen containing PIN flame retardant (silicon polyphosphoramide, DM-Si). At % loading of DM-Si, LOI (limiting oxygen index) of PLA was increased from 19.8 to 27.9 and peak heat release rate reduced by 15%, achieving UL 94 V-0 (3 mm). Tensile strength and transparency were not significantly modified, and toughness was improved.

"A Si-containing polyphosphoramide via green chemistry for fire-retardant polylactide with well-preserved mechanical and transparent properties", J. Feng et al., Chemical Engineering Journal 431 (2022) 134259 https://doi.org/10.1016/j.cej.2021.134259



Iron alginate bio-based PIN FR for epoxy

Iron alginate at 8% w/w in epoxy resin halved both peak heat release rate and smoke release rate in epoxy. Iron alginate was produced by aqueous reaction of sodium alginate, which can be extracted from marine plants, with the ferric salts, then dried, pulverised and mixed into epoxy resin during curing. With 7.9% w/w iron alginate, pHRR (peak heat release rate) was reduced by 52% compared to neat epoxy, peak smoke production rate by 48% and total smoke production by 13%, with even greater reductions at 14.6% w/w. Release of volatile hydrocarbons and carbon monoxide during combustion were reduced, contributing to lower flammability and toxicity. Mechanical properties of the epoxy were not deteriorated and impact strength was increased. The fire resistance effect of the iron alginate is shown to result from lower volatile gas emissions and compact char formation.

"Epoxy/iron alginate composites with improved fire resistance, smoke suppression and mechanical properties", C. Liu et al., J Mater Sci (2022) 57:2567–2583 https://doi.org/10.1007/s10853-021-06671-x

PUBLISHER INFORMATION

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For abbreviations see: www.pinfa.org

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