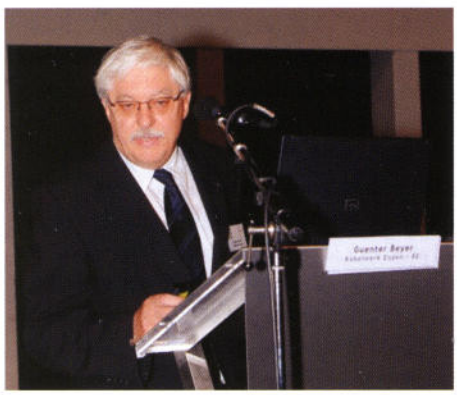
New FR Standards and Developments

Lado Benisek reports on the International Conference on Fire-Safe Textiles, Foams and Composites



Dr Guenter Bayer

Oliver Toepfer

Myriam Vanneste

CENTEXBEL, BELGIUM, recently organised an International Conference on Fire-Safe Textiles, Foams and Composites. 130 participants attended this event with many novel features, co-sponsored by **EFRA** (European Flame Retardant Association) and **PINFA** (Phosphorus, Inorganic & Nitrogen Flame-Retardants Association).

Great Lakes introduced Emerald 1000, a sustainable brominated flame-retardant as a replacement for Decabromodiphenyl ether. Its polymeric structure makes it not readily bioavailable, thus reducing environmental concerns that threaten the sustainability of many current brominated products. As a replacement for 'Deca', Emerald 1000 requires little or no reformulation. It has a high bromine content making it more efficient than other Deca alternatives.

Presently, there are significant differences in national flammability standards for home and rail textile interiors in individual European countries. **Franck Poutch (Crepim, France)**, introduced a new European standard for railway interiors, CEN/TS 45545-2, which is expected to become applicable in 2012-13.

The key criteria for fire assessment of textile interiors are: flame spread, ignitability, rate of heat release, smoke and toxicity. In the case of a seat, a full assembly is evaluated in a laboratory cone-calorimeter test and in a full-scale seat test. Wall coverings are evaluated in a vertical radiant-panel test and carpets in a horizontal radiant-panel test, all being ISO tests. This unification of EU flammability tests for textile rail interiors would bring considerable savings to suppliers, presently having to test the same textile to different national tests in every EU country.

Nanocomposites

The use of nanocomposites to enhance the thermal stability of polymers, improve flame-resistance and charring, while reducing smoke emission was presented by **Dr Guenter Bayer, (Kabelwerk Eupen AG, Belgium)**. As an example, the addition of 5% of a nanocomposite compound to EVA (ethylenevinylacetate), a polymer used for the back-coating of textiles, results in low flame propagation in a vertical flame test and no dripping. Combination of organoclays with aluminium trihydrate improves char formation at only a 5% add-on level for polymer FR back-coating.

Aluminium trihydrate (ATH) is well-known as an inorganic FR additive. **Oliver Toepfer (Nabaltec, Germany)** introduced additional environmentally friendly mineral flame-retardants that use heat energy from flame to release water and convert to the appropriate metal oxide – magnesium hydroxide, which decomposes at 300°C (ATH at 200°C), and aluminium hydroxide (AlOOH) at 340°C – offering different FR-initiation temperatures, depending on the polymer. The lower the particle size of ATH, the higher the Limiting Oxygen Index (LOI).

Another alternative is the use of red phosphorus at 6-8% level, which is highly effective, but acceptable only for dark products. A metal phosphinate, such as diethyl phosphine aluminate, is another example of a halogen-free FR alternative, particularly when combined with zinc

borate. The latter works as a synergist with alumina by forming a glass and improved char.

Basalt

Centexbel is involved in research on FR textiles. Some examples are: FR functionalisation with nanoclays; intumescent materials with improved FR properties for building and transport applications; and sustainable FR technical textiles from recycled polyester. **Myriam Vanneste (Centexbel, Belgium)** mentioned that nanoclay-layered silicates, based on 1nm-thick platelets, held together by Van der Waals forces, offer not only FR but also UV resistance. Nanoclay can be incorporated into a polymer such as PA6 for FR functionalisation. Development of UV-curable FR coatings is being also initiated.

Basalt is an inorganic fibre made from volcanic magma, solidified in open air. It is a thermoplastic material; when heated to 1500°C, it liquefies. The development of basalt fibre has been concentrated in Russia and the USA, for military applications and aerospace. Chemically, basalt is similar to E-glass, but it has a much higher iron, magnesium and sodium content, according to **Ko Cattoor (Basaltex, Belgium)**. As a natural inorganic fibre it does not produce smoke and toxic gases.

Basalt fibre has a higher tensile strength and modulus than E-glass, but it costs about €5/kg, compared with 1/kg for E-glass. The advantage of a basalt fabric is that a flame from a propane torch at around 1000°C cannot break open the fabric, while in the case of E-glass fabric it will break open. This makes basalt fabrics ideally suitable as fire-blockers for transportation seats, fire curtains and FR-composite reinforcements. For enhanced fabric stabilisation, an FR coating might be required.

PU Coatings

Devan (Belgium) has developed new FR solutions for PU coatings, based on phosphorus compounds not prone to hydrolysis. Ecoflam PU 222, PU 254 and PU, when applied to upholstery, comply with EN 597-1 and EN597-2 cigarette and match test as well as M1 of the French Epiradiateur NF 92504 test. Ecoflam products give a similar performance, after soaking and washing, to classical halogenated FR products, according to **Alain Longerock**.

Volker Butz (Thor GmbH, Germany) presented a range of phosphorus and nitrogen FR compounds for textiles. Flammentin FMB/UCR, or TL 1464, is a semi-permanent flame-retardant applicable by pad-dry-cure at 160°C, when reaction takes place with cellulose. For application of an FR with a binder back-coating, Aflamman TL1313 is recommended as a semi-permanent finish.

New highly effective phosphonates have been developed for coatings, based on phosphorus and nitrogen – Afflamit PCO 700, Afflamit PCO 800 and Afflamit PCO 960. Permanent FR effects, by incorporating flame-retardant compounds in the spinning dope for PP, PA and PET, can be achieved with Afflamit PCO 900. This FR

Volker Butz

Ivan Heyvaerts

compound acts in the gas and solid phase and achieves better performance than antimony/halogen FRs. Another alternative for PET is Afflamit PE conc, a cyclic phosphonate acid ester, soluble in water, that imparts permanent effects.

Viscose

Utexbel (Belgium), one of the few vertically organised fabric manufacturers, from spinning to finishing, has developed an inherently FR fabric for protective clothing against fire and molten metal – LAV pro – with excellent shrinkage and mechanical properties. Lenzing FR viscose is the main component of this fabric, which has excellent FR and protection against molten metal. Para-aramid is the second component that strengthens the fabric, resulting in no break-open on flame exposure.

The fabric weighs only 260 g/sqm for superior wear and thermophysiological comfort, while it does not shrink on flame/heat exposure, unlike aramids, resulting in lower heat transfer. According to **Ivan Heyvaerts**, this fabric complies with a range of EN ISO tests for heat and flame protection, protection against weld sparks, heat shrinkage at 180°C and 260°C, chemical repellency, electrostatic properties and electric-arc protection. **ID**