

Flame-protected foams

Flame retardancy in particle foams and extrusion foams – halogen-free flame retardants – polymer-based flame retardancy – characterization of combustion behavior

Thermoplastic foams have thermal insulation properties, a high capacity for energy absorption and specific mechanical properties that make them suitable for a wide range of applications.

Areas of application for thermoplastic polymer foams include:

- Automotive sector
- Energy sector
- Aviation
- Transport
- Packaging
- Construction sector

In particular in the construction sector, flame retardancy and the resulting combustion behavior of insulating foams is significant to the origin and spread of fires and to smoke production. Until recently the halogen-containing flame retardant hexabromocyclododecane (HBCD) was used for the flame protection of thermoplastic insulation materials. It has been classified as a substance of very high concern by the EU under REACH (Regulation (EC) No 1907/2006) due to its persistence, bioaccumulation and toxicity, and its production and use has been banned since August 2015. The flame retardant formulation of foams is therefore being modified to increase the safety of both humans and products. The use and investigation of alternative flame retardants is therefore an important research topic at Fraunhofer ICT.



*Above:
Flame-
retardant
compounds*

*Left:
Flame-
retardant
foams*

Advantages

Fraunhofer ICT is developing and testing new combinations of flame retardants in thermoplastic foams. The mode of action and operating temperature of the flame retardants, as well as their compatibility with different polymer systems, can be adjusted according to requirements and according to the desired application field.

The resulting advantages are:

- Decreased flammability
- Minimal spreading of the fire
- Reduced smoke emissions



Limited oxygen index measurement at Fraunhofer ICT



Flame-retardancy test on foams at Fraunhofer ICT

Investigation and characterization of flame-protected foams

Various characterization methods are available at Fraunhofer ICT to test polymer compounds, foamed semi-finished products and components according to the following standards:

- Small burner test (construction sector)
 - EN ISO 11925-2-2010
 - DIN 4102-1 (B2)
- UL 94, ASTM D 3801 (e.g. cables, automotive, general flame protection)
- DIN 75200, FMVSS 302 (automotive)
- ASTM D 6194, DIN EN 60695-2-10, glow wire test (e.g. cables, general glow test)
- ASTM D 2863, oxygen index, LOI (general flame protection test)
- PART I FAR 25 853 (F1 and F2), AITM 2.002 (aviation)

Manufacture of flame-protected foamed products

At Fraunhofer ICT, various processes are used to develop and produce flame-protected foams. A wide variety of different dosing equipment is used to incorporate polymer-based, liquid and powdered flame retardants and synergists into a polymer matrix. Comprehensive know-how and equipment is available for the production of foamed semi-finished products and components, both in the particle foam and in the extrusion foaming process.

In the particle foam process, an extrusion line with a subsequent underwater pelletizing unit is used to produce foamed particles. Alternatively, autoclaves with different volumes can be used to develop flame-retardant particle foams. For the further processing of these particles into a foamed product, prefoamers and steam chest molding lines (made by Erlenbach GmbH) are available at Fraunhofer ICT on a laboratory and industrial scale, along with a radio-frequency-based molding machine (made by the company Kurtz).

Furthermore, semi-finished products such as foam sheets or foils can be produced continuously in the pilot plant, in an extrusion foam process using the Krauss Maffei-Berstorff Schaumtandex ZE 30/KE 60 laboratory line.

Service portfolio

- Material and formulation development for the production of tailored, flame-retardant foams
- Optimization of technical property profiles
- Process optimization for incorporation of flame retardants
- Characterization of flame-protected matrix materials and foams
- Particle and extrusion foams
- Tailored solutions

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