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FRAUNHOFER INSTITUTE FOR
CHEMICAL TECHNOLOGY ICT

FIRE PROTECTION FOR BUILDINGS

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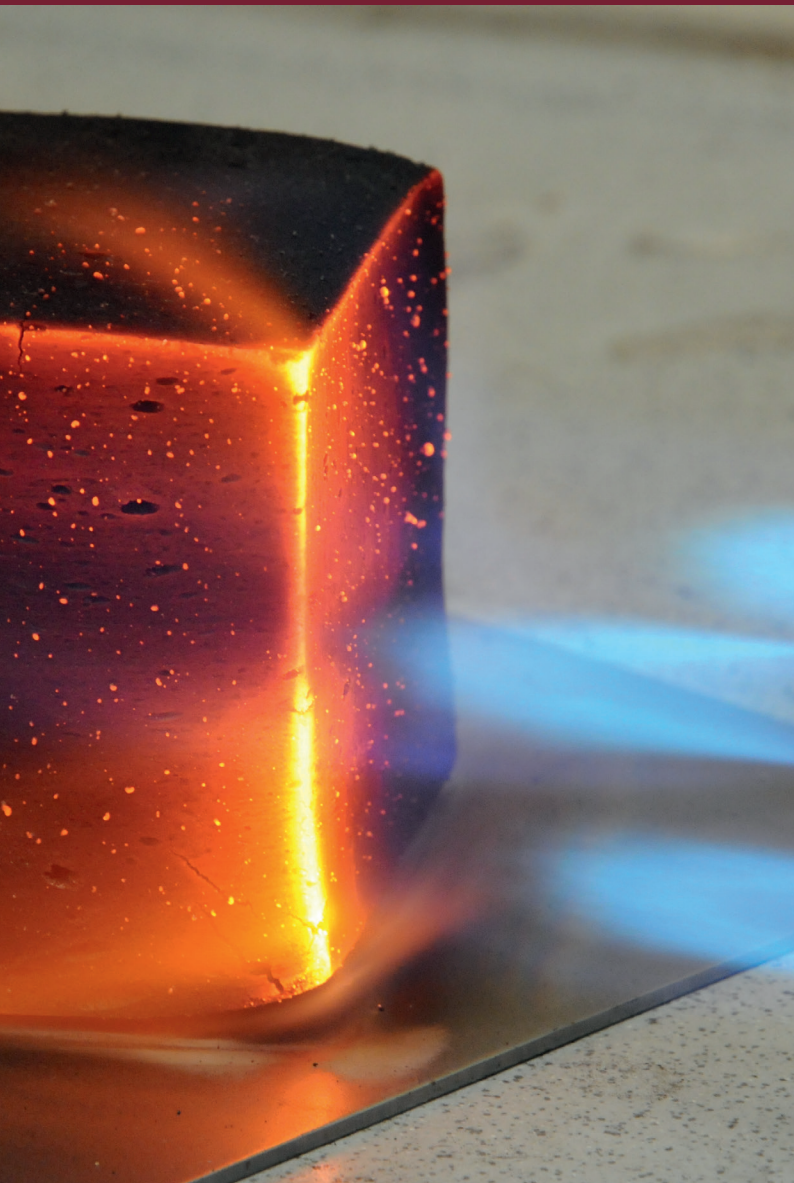
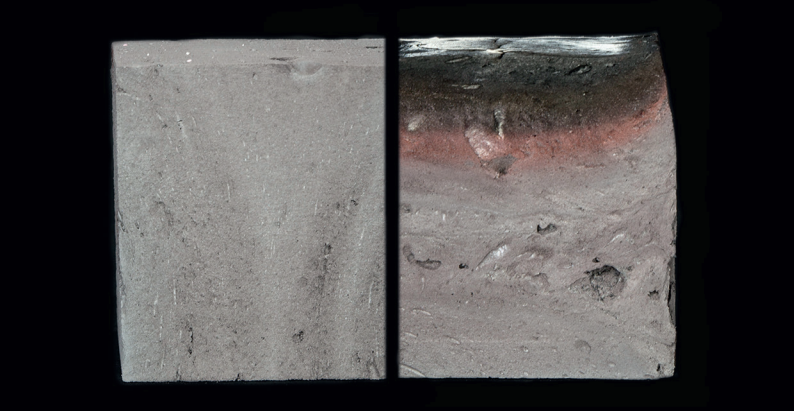


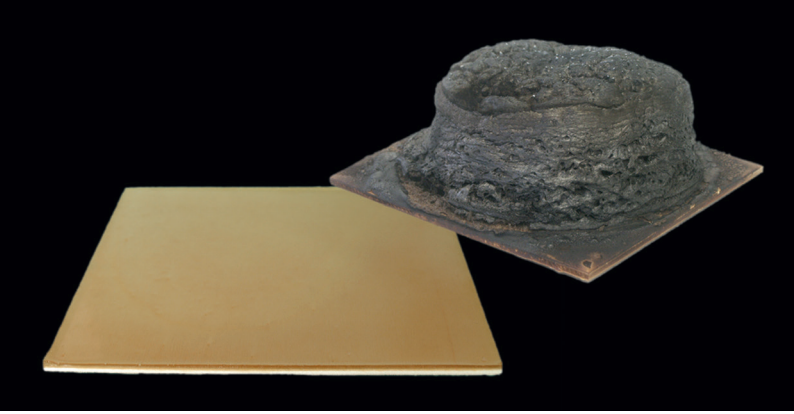


FOAMS – "NON-FLAMMABLE" AND DIMENSIONALLY STABLE

Insulation consists mainly of foamed plastic (polystyrene, PU) or natural fibers. With the exception of insulation made from mineral wool, these materials are combustible and can contribute to fire propagation. A fire-resistant foam can increase the safety of multistory buildings by preventing fire propagation on the insulation of facades. New, plastic-based foam formulations maintain their dimensions in a fire test without burning themselves. An application for these foams could be insulation panels for facades.

The walls of ships and aircrafts are made of sandwich panels with a foam core. Particularly in shipbuilding, the requirements for fire prevention are high. Ceramic-reinforced foams are characterized by high strength on exposure to fire and could be used as a foam core for stabilizing a fire wall built in sandwich construction.

IMAGE ABOVE *Foam before (left) and after (right) fire test.*
IMAGE LEFT *Flame treatment of a foam.*



FIRE PROTECTION COATING FOR WOOD

From an environmental viewpoint construction materials made from renewable raw materials are gaining popularity. However, they have a crucial disadvantage compared to competing materials like masonry, concrete or steel: Wood is combustible.

The building code of the German federal states defines minimum requirements concerning the combustibility of building materials and the fire rating of building components. As a consequence the use of wood in multistory buildings is limited. Intumescent coatings could contribute to extending the range of applications, as they significantly delay the ignition. They are applied as opaque or transparent paints on wooden plates.

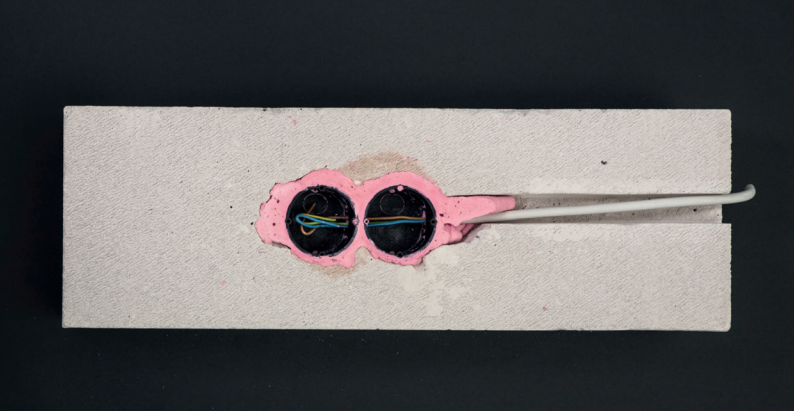
During a fire they form a voluminous foam which protects the underlying wood and prevents or delays the ignition. In a cooperative project of the Fraunhofer institutes WKI and ICT new, high-performance fire protection coatings for wood were developed with improved fire performance, scratch and abrasion resistance as well as improved moisture resistance compared to commercial products.

IMAGE LEFT *Transparent intumescent coating.*
IMAGE RIGHT *Foam after fire test.*

FIRE-RESISTANT WINDOW AND DOORS FILLED WITH FOAM

Fire-resistant windows and doors are made of aluminum or steel. The interior of the profile is filled with a cooling filler or contains sheets made of gypsum or silicate. The former can be introduced by the factory, and the windows fitter is only required to cut the profiles to length. The latter requires additional cutting of the slide-in sheets after cutting of the profiles. This is time-consuming and error-prone. A simpler and more cost efficient method is the foaming of the profile chambers in the factory with a fire protection foam. The foamed profiles can be cut to the required length. Subsequent cutting and inserts are no longer required. PU foams are unsuitable because of their decomposition at fire temperatures, their lack of dimensional stability and the loss of the fire-protection properties. The newly-developed foams maintain their dimensions during flame treatment. A fire-resistant window profile with foam and conventional sheets is shown in the photograph.

IMAGE LEFT *Section through window profile with fire-resistant foam (left) and conventional sheets (right).*
IMAGE RIGHT *Foam after fire test.*



INSTALLATION FOAM

Due to the easy application and timesaving procedure the current trend is to use expanding foam for mounting doors and window frames as well as filling cavities. The new development widens the use of expanding foams towards the mounting of electric outlets. Up to now electric outlets have been plastered into the wall cavity, which is a time-consuming and painstaking procedure for the craftsmen. The opportunity to fix electric outlets with expanding foam could lead to considerable time savings and simplification of work. Commercially-available polyurethane expandable foams are not suitable because of the slow secondary foaming which make an easy and fast positioning of the outlet in the wall cavity impossible. For this purpose the expanding foam should not exhibit any secondary foaming and should be applicable on-site. Work is currently focused on the implementation of expanding foams in an appropriate application system.

IMAGE *Wall segment with electric outlet fixed with expanding foam.*

POWDER COATINGS FOR FIRE PROTECTION OF STEEL

Powder coatings are among the most modern and environmentally friendly coating systems. Due to their high-quality coating properties, they are gaining acceptance for an increasing number of applications. Powder coatings are widely used as corrosion protection in steel construction. Steel girders in buildings are additionally provided with a liquid insulating layer for fire protection. Due to increasingly complex applications and price pressure in steel construction, the formulations of fire protection coatings are constantly being further developed. In an R&D cooperation project sponsored by the BMWi, modular protective systems forming an insulating layer are currently being developed along with intumescent hybrid systems and intumescent complete systems consisting of powder coatings and liquid coating systems. These represent an economical alternative to the intumescent liquid fire protection coatings currently available on the market.

For more information go to:
www.zaft-dresden.de/fis/project/215587/

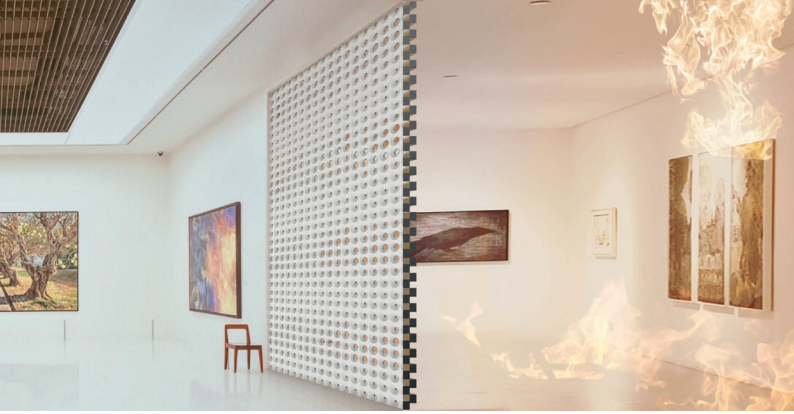
IMAGE *Powder coating on a metal plate (© ZAFT).*

FIRE TESTS ON LABORATORY SCALE

In order to evaluate fire protection performance and fire behavior prior to certification testing, building products can be examined cost-efficiently on a small scale using a laboratory flammability test stand and in a special high-temperature laboratory furnace. The behavior of coatings can be determined using the flammability test stand. Further investigations and pre-tests, which are more closely oriented to the certification tests, are possible with the STT Mufu+ laboratory firing furnace (Standard Time Temperature Muffel Furnace). The furnace simulates the scenario of a full-scale fire according to the ETK (standard timeunit temperature curve, ISO 834) on a laboratory scale. The SST Mufu+ was developed by the BAM (Federal Institute for Materials Research and Testing) in order to carry out a more cost-effective screening under laboratory conditions before complex and expensive tests in standard furnaces.

With these two laboratory fire tests, Fraunhofer ICT can test evaluate the fire behavior of very small samples of building products in advance of costly large-scale tests.

IMAGE *Laboratory furnace.*



DESIGN STUDIES

Product design plays an increasingly important role in new products entering the market. Fire protection is generally seen as a necessity. Design studies aim to show that fire protection can be part of the product design. Besides communicating the benefits of the product, they also show how design and fire protection can be combined. The conceptual design of product solutions takes place in cooperation with product and industrial designers. One example of this cooperation is the functional open firewall shown above, which could be used as a room divider in open-plan offices, halls or as a decorative partition. In the event of fire, the openings are mechanically closed and the necessary fire resistance is achieved by a fire protection coating.

IMAGE *Application example.*

PROTECTION OF PLASTIC SHEETS

Lightweight construction is becoming increasingly important in shipbuilding, automotive construction and aviation engineering. Plastic-based fiber composites and sandwich plates are used to reduce weight. The ever-increasing fire protection requirements, for example in ship and rail traffic, represent a challenge for these materials. One way of improving the fire protection performance is to coat plastic sheets with an intumescent coating. In the event of fire, a foam is formed that protects the plastic from decomposition and prolongs the functional integrity of the component. A further advantage of a coating over the use of fillers is the preservation of the material properties, which is particularly advantageous in the case of mechanically highly stressed plastic parts.

IMAGE *Intumescent coating on sandwich plate.*

OUR OFFER

Development and adaptation of fire protection and high-temperature insulation materials and applications for specific tasks according to customer requirements in the areas of:

- Fire protection coatings
  - Intumescent
  - Ablative
- Flame-resistant foams
- Ceramizing coatings
- Ceramic filler
- Potting compounds

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