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Research area: Product aims

Paper, paperboard and board // Technical specialty papers

Key words:

Fire protection, light weight composites, construction materials

TITLE:

Development of non-combustible lightweight composite systems based on thin fire protection boards including reinforcement fibres and using highly mineral filled papers for hollow structures

Background/Problem area

Lightweight materials are used in the fire protection sector primarily as non-load-bearing inner walls or panels for suspended ceilings. Fire protection materials must mainly be lightweight, temperature-resistant and especially non-flammable. In addition, they have to be mechanically stable, easily processable and inexpensive.

Most of the materials used today are relatively inexpensive, but high density and limited fire resistance often prevents them from being used e. g. as ceiling panels in escape routes. Because of their high temperature resistance and non-flammability, composites comprised of thin fire protection boards with reinforcement fibres (dünne Brandschutzplatten mit Faserarmierung, „düBraFa“) and highly mineral filled papers lend themselves well to the production of lightweight structures to be used as construction material for fire protection.

The main raw materials used for the production of düBraFa – fillers and fibres – will be available in big quantities and at low price also in the long term. The production of highly mineral filled papers by means of paper-technological forming methods provides an effective option to obtain shaped, thin-walled lightweight composites (e. g. honeycomb structures). The combination of highly filled papers with düBraFa leads to a lightweight, non-flammable construction material for fire protection in the building industry.

Objectives/Research results

Main goal of the project was to develop düBraFa and non-flammable papers highly filled with mineral-based fillers, and to manufacture a lightweight composite building material comprised of these two components. For the production of lightweight structures, paper-technological forming and converting methods should be usable. The results should lead to the development of a thin composite board offering maximum fire protection properties, low density and adequate strength properties at a minimum content of organic fibers.

Based on the experience available at PTS, papers highly filled with mineral-based fillers were produced in laboratory scale. The papers were subsequently impregnated with different salt-based solutions, cured and tested to determine the strength properties relevant to building materials as well as basic flammability characteristics. In the following project part, forming trials of the impregnated papers were carried out in laboratory scale to obtain corrugated structures which were joined with düBraFa samples, produced by the project partner, leading to composite structures. A trial on the pilot paper machine of PTS validated the transferability of the laboratory results to continuous paper production. The paper produced during the pilot trial was formed to honeycomb structures, impregnated and joined with large-format düBraFa to large-size composites. A Single Burning Item (SBI) test showed that fire protection class A 2 was reached by the new building material. The bulk density of the composite amounted to approx. a fourth of standard fireproof building materials. The requirements regarding bending strength and modulus of elasticity were fulfilled.

Application/Economic benefits

Composite building materials derived from düBraFa and highly filled papers and suitable for fire protection are not state of the art yet. The seemingly perfect combination of wood material technology, mineral-bound boards and paper technology offers the opportunity of concerted material and process development. A lightweight fireproof building material can be produced from reasonably priced raw materials with guaranteed supply, which provides especially small and medium paper converters with an opportunity to build or adapt new product lines and reach new customers.

A high market potential can be expected for lightweight fireproof composites suitable as building materials. Users are offered a new product that has several advantages over conventional fireproof building materials: it is lighter than gypsum boards and bound mineral fiber products, and more moisture resistant. Therefore, light-weight fire protection composites can be expected to fill an important gap in applications requiring low density together with high temperature resistance and non-flammability. These requirements cannot be met to the same extent by the building materials currently available.

The development of a light-weight composite material with the highest fireproof rating will enable SME to do business with sectors of the building industry whose high requirements had prevented suitable product offers from SME so far.

Period of time: 01.04.2011 – 31.06.2013

Remarks

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