Fully recyclable, non-combustible insulating material made of mineral plastic for use in building construction, vehicle construction and housings for electronic devices

TLB
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The new developed mineral plastic foam, as a bio-inspired hybrid material, can solve many of the problems associated with conventional insulation and damping materials used in building construction, automotive engineering and the housing of electrical devices. Despite its excellent processability, the innovative material is inexpensive, non-combustible, economical, environmentally friendly and can be recycled in a sustainable way in terms of energy.

- Non-combustible, economical, environmentally friendly and energetically sustainable recycling
- Inexpensive
- Pore sizes (20 to 1000 µm) and their distribution in the foam are adjustable
- Excellent workability and stability (0.5 to 1.2 MPA, five to six times harder than conventional acrylic glass)
- The intermediate material hydrogel is shapeable, stretchable and self-healing

Application

Use in building construction, automotive engineering and housings for electronic devices.

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TRL3 - Proof of concept

Patent Situation

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Service

The Technologie-Lizenz-Büro GmbH is in charge of the exploitation of this technology and assists companies in obtaining a license.

Background

Energy-efficient construction and home improvement or refurbishment are becoming increasingly important. Rising energy prices as well as governmental requirements and support programs for energy saving and the avoidance of climate-damaging greenhouse gases will further increase the importance of suitable for insulation and lagging in the coming years. Insulation materials in the building industry therefore have considerable market potential. Global consumption of insulation materials is expected to reach up to 579 million cubic meters in 2025, with Europe alone accounting for more than 200 million cubic meters. In regions with rather colder climates, thermal insulation minimizes heat loss and thus energy consumption, whereas in hotter climates insulation acts as a heat barrier. The latter is also becoming increasingly important in the more temperate zones as a result of climate change. Fire safety and potentially harmful additives contained in insulation materials as well as their environmentally sound disposal after use are problems that have not been satisfactorily solved so far and require unpleasant compromises.

Problem

Many plastic foams are combustible, which makes their use as insulating material in building construction, e.g. for facade insulation, and in automotive engineering or housings for electronic devices difficult or impossible. In several cases of major fires in the recent past (e.g. Grenfell Tower, London), it is suspected that the fire was able to spread massively within a few minutes, partly due to the facade insulation made of conventional, combustible plastic foams. In addition, the production of these usually non-biodegradable plastic foams based on petroleum, which can only be recycled with energy input, is a major ecological challenge.

Solution

The newly developed mineral plastic foam is a bio-inspired hybrid material. By adding a sodium carbonate solution to a polyacrylic acid and calcium chloride solution, a hydrogel is formed as an intermediate product after foaming and gelling. This hydrogel is shapeable, stretchable and self-healing. By hardening the hydrogel, the macroporous mineral plastic foam is obtained, which retains the shape of the hydrogel that it has taken on in the swollen state. The mineral plastic foam is five to six times harder than conventional acrylic glass, but still easy to process. Due to its mineral content of up to over 30 mass percent, it is non-combustible, unlike purely organic polymers such as polyethylene (PE). The ingredients calcium, calcium carbonate and polyacrylic acid are harmless to health. For example, high-molecular, cross-linked polymers of acrylic acid ("carbomers") are components of eye drops and eye gels (artificial tear substitute). The mineral plastic foam can be completely dissolved in many conventional acids, making recycling simple and efficient.