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Project Title: AeroBasalt – Development of an energy-efficient, ultralight and recyclable fibre reinforced composite made of basalt fibres and silicate aerogels

Partner: GETA mbH

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Funding agency: BMBF

Mission Statement

The German government considers increasing energy efficiency as the key to exit from nuclear and fossil-fuel energy and is pushing this forward through legal regulations (e.g. Energy Conservation Act (EnEV)). A significant proportion of primary and energy consumption occurs in the building sector. The reduction of heat losses and thus the use of building insulation leads to enormous energy savings.

Currently, composite thermal insulation systems (ETICS) with insulation boards made of rigid foam (polystyrene/polyurethane) and a top layer made of textile-reinforced plaster reinforcement are mostly used as insulation material for buildings. The eco-balance of these composite systems is inadequate because fossil raw materials and a considerable amount of energy are required to manufacture them (rebound effect). In addition, there are currently no large-scale processes for recycling polystyrene-ETICS. The ETICS must be disposed of as hazardous waste or recycled thermally after their service life.

A further problem with the use of insulating materials with organic plastics is their fire behavior. Although these are defined according to DIN 4102-1 as flame-retardant (fire class B1), major fires from the past show that they cannot be extinguished in a controllable manner. Furthermore, the developing smoke gases are subject to a high toxic load.

In summary, there are three major disadvantages of the currently most frequently used ETICS:

- Consumption of fossil raw materials during production
- No recyclability
- Critical fire behavior

The objective of the project is therefore to develop and test an energy-efficient, ultralight, recyclable composite based on a basalt fibre core and a matrix material of silicate aerogels for use as an insulating material for indoor and outdoor applications.

Solution

In this cooperation project, a fibre composite system is being developed which has excellent insulating properties without the disadvantages mentioned above. With a fibre core of basalt (fibre reinforcement) and a matrix material of silicate aerogels, the composite system will consist of purely mineral (inorganic) materials. The following advantages for the composite system result from the material properties of the individual components:

- Excellent insulating properties with 4 - 20 mW/(mK)
- Unlimited production resources
- Maximum fire resistance (fire class A2)
- Disposal as construction waste after end of life cycle
- Low weight (lightweight applications)

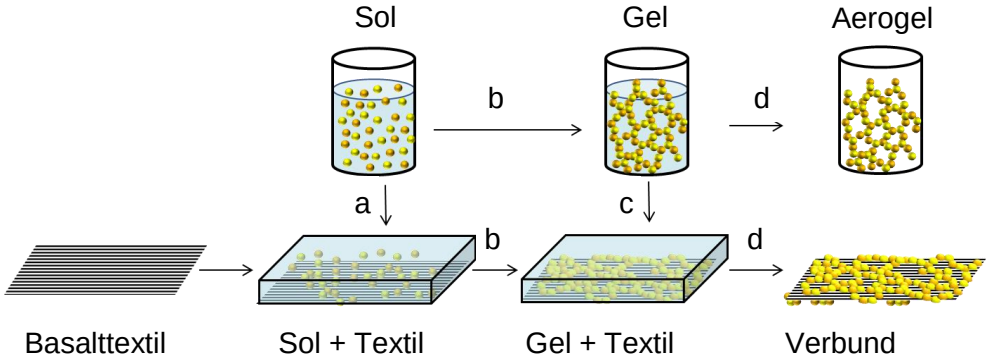

Figure 1: Schematic representation of possible manufacturing processes, a) impregnation with ungelled aerogel solution, b) gelation, c) impregnation with gelled aerogel solution or gelled aerogel paste, d) drying in autoclave

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