



Resource- and Cost-effective Silica Aerogel Granulate with Tailored Surface Chemistry and Particle Size Distribution

Invention

A complete manufacturing concept for the fast and efficient production of silica aerogel includes minimized solvent consumption, solvent recycling without purification, and a tailorable surface chemistry and particle size distribution. Thermal conductivity and mechanical properties are on par with the highest performing industry benchmarks. The process has been implemented at the large, pre-industrial pilot scale, and the materials quality validated by market-leading end-users of silica aerogel granulate. Detailed engineering designs and cost estimates for a first production line are available.

Background

Silica aerogel is the ultimate thermal insulator, but expensive due to inefficiencies in the production technology. Silica aerogel is available in the form of fiber reinforced mats, granulate and powder, and constitutes a rapidly growing global market for industrial insulation and, increasingly so, building insulation and electro-mobility applications. However, the current high production costs, combined with limitations in the supply chain with only very few credible manufacturers, hinder mass-market uptake and limit application development activities.

Advantages

The basis for the production concept is the inclusion of the hydrophobization agent from the start of the production process, but with a delayed activation by the addition of a catalyst (patent granted) [1]. This accelerates the production process, minimizes solvent consumption to the theoretical minimum, and facilitates the closed-loop, re-use of solvent without purification. The engineering of the pilot plant maximizes heat and mass transport into the gel to further reduce production time and maximize throughput and capacity (patent granted) [2]. Finally, the gels can be dried to aerogels by simple evaporative drying. Optionally, the hydrophobicity and surface reactivity of the aerogel granulate can be tailored for specific applications, through a simple intervention during the drying step (patent pending) [3]. The entire process has been implemented and optimized at the large, pre-industrial pilot scale.



Applications & Properties

Silica aerogel granulate is incorporated in superinsulating aerogel renders or insulating concrete, used directly as a filler for cavity walls or daylighting systems, or pressed into insulation boards. The silica aerogel granulate has a material and tap density of respectively 115 and 75 kg/m³, a thermal conductivity of 19.2 mW/(m.K) at 20°C for the packed bed, a water contact angle of 150° and a tuneable particle size (between 1 and 4 mm).

Ownership

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Patents

- [1] Process for the production of an aerogel material - AU2014298538B2, priority date 02.08.2013.
- [2] Method for producing an aerogel material - AU2016214370B2, priority date 04.02.2015.
- [3] Verfahren zur Herstellung eines Aerogelmaterials – WO2019170264A1, priority date 05.03.2018;
Silica aerogel with increased alkaline stability – patent application, priority date 30.04.2020.

Keywords

Silica aerogel, production technology, thermal insulation, hydrophobicity

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