Aerogel + Aerogel = Aerogel²
Developments on Aerogel-Aerogel Composites

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Aerogels are extremely light nanoporous materials synthesised via a sol-gel route. As a result of the condensation polymerisation they have an organic or inorganic polymeric molecular structure with a porosity of up to 99.9%. They possess fascinating properties, like extreme low thermal conductivities, low densities, and huge inner surface areas. The mechanical properties like bending and compression strength are for nearly all aerogels very low so that their use for industrial application is limited.
We therefore developed composites with an organic aerogel serving as a matrix based on subcritically dried Resorcinol-Formaldehyde (RF) and inorganic supercritically dried aerogel granulates as a filler material based on Silica, Titania, Zirconia or Carbon. The preparation to get a homogenous monolithic material is tricky. To improve the strength of the composites they are reinforced by cellulose fibres.
The amount of granular aerogels embodied in the RF-aerogel and the amount of cellulose fibres can be varied to a large extent. We achieve thermal conductivities in the range of 0.03 to 0.06 W/Km and strengths up to 2 MPa, while the densities are around 100 kg/m^3. Load deformation curves in crushing tests can exhibit a long plateau, indicating the possibility to use these composites as crash energy absorbers.
The presentation describes in detail the preparation and the mechanical and thermal properties as well as possible applications.