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| **Project titel:** | Silica Aero - Validation of the innovation potential of porous silica aerogel fibers in the area of thermal insulation |
| **Partner:** | Deutsches Zentrum für Luft- und Raumfahrt |
| **Duration:** | 11/2016 – 10/2020 |
| **Funding Agency:** | BMBF VIP+ Validierung des technologischen und Gesellschaftlichen Innovationspotenzials wissen schaftlicher Forschung |

Mission Statement

More than 90 million vehicles are produced worldwide per year and in the Federal Republic of Germany it is more than 5,900,000 vehicles (according to the International Automobile Manufacturers Association OICA, 2014). These vehicles require insulation for the catalyst which must be thermally stable up to 800 °C, because the efficiency of the catalyst depends on the temperature for which 800 °C is ideal. Plastic nonwovens and foams are flammable at these temperatures and most of the glass fibres can be used up to 600 - 700 °C. Keramic fiber nonwovens are expensive, carcinogenic and not suitable for automotive applications. Normal silica aerogels are not workable/mouldable and very sensitive to vibration. The only materials that can be used today are silica fibre fleeces, which are resistant up to 1200 °C. These nonwovens require a thickness of up to 1 cm to achieve the necessary insulation effect and protect the other components of the car from the heat. These fleeces are heavy (156 kg/m³) in contrast to Aerogelen (100 mg/cm³). Moreover, the silica fleeces require more space than aerogels to have the same insulating effect. This makes aerogels much more suitable as they can reduce the installation space. The thermal conductivity of silica aerogels is 0.012 to 0.021 W/m·K, that of silica fibre fleeces 0.042 to 0.190 W/m·K.

Only in the form of fibers developed here, aerogels are flexible and formable, analogous to glass or ceramic materials. This allows their use in various areas of insulation, such as the insulation of catalytic converters (automotive) or turbines (aircraft). A manufacturing process for aerogel fibers was developed at the Institute for Textile Technology at RWTH Aachen University. According to the current state of the art, the process is unique in

its form. The world's first aerogel fibers were produced at ITA/DLR and their insulation properties tested in space (Rexus project).

Approach:

The aim of the research project is the development of an industrially applicable Process for producing silica aerogel fibers. For this purpose the basic sol-gel process for the synthesis of the spinning mass is chemically and technically optimized, especially with regard to reproducibility and influence of the properties on the later fibre.

In parallel, the behaviour of the mass in the spinning process is investigated. For this reason the mechanical behaviour, as well as the composition, of the coagulation bath in the wet spinning process is investigated. In addition different spinning parameters with regard to the best possible product is selected. The development is economically supported by various market research projects and process cost analyses to enable the industrial use.

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