Technical devices and further development for the production of aerogel nonwoven

Daniel Wolters[1], Jens Mroszczok[1], S. Kammler[1], Maximilian Mohr[1], Thomas Gries[1]

[1]*Institut für Textiltechnik (ITA) of RWTH Aachen University, Aachen, Germany*

Daniel.Wolters@ita.rwth-aachen.de

Abstract:

The ambitious German climate goals target a 55 % reduction of greenhouse gas emissions by 2030, compared to the level of 1990. To reach this goal appropriate insulation materials are needed. Aerogels are dried gels with a very high porosity. They are consisting of up to 99.9 % air. Hence, aerogels have a high specific surface area (SSA) which leads to an extreme low thermal conductivity of up to 0.013 W/(m·K). Compared to conventional materials they show remarkable thermal insulation properties.

A technical scale production process of aerogel non-woven has been developed at the ITA as part of J. Mroszczoks dissertation in accordance with a project called “EvA” (FKZ 19U14008D, BMWi). The developed aerogel filament nonwoven at ITA show a SSA of 202 m²/g and a thermal conductivity of 0.06 W/m·K. Due to the low density of these aerogel nonwovens, manufactured from polyacrylonitrile (PAN), they are flexible while exhibiting an excellent insulation compared to the weight. This provides the best conditions for further investigations in the project “Chrysomallos” (FZK 20E1906, BMWi). In this project the goal is to use of aerogel nonwoven as airplane insulation in order to reduce the weight and therefore the fuel consumption. An Airbus A320 airplane for example will approximatively weight 600 kg less compared to the same aircraft with the common insulation material. The production process can be scaled up economical to produce aerogel non-woven at a prices below 3 €/m² which allows aerogel nonwoven to be an inexpensive alternative.

For this purpose, numerous preliminary experiments have already been evaluated. For example, computer thermographic (CT) Images provided insight in the nonwoven structure and indicated that the filament formation needs to be improved. In order to improve the filament formation and overall performance, a new nozzle design based on the existing plant was investigated.

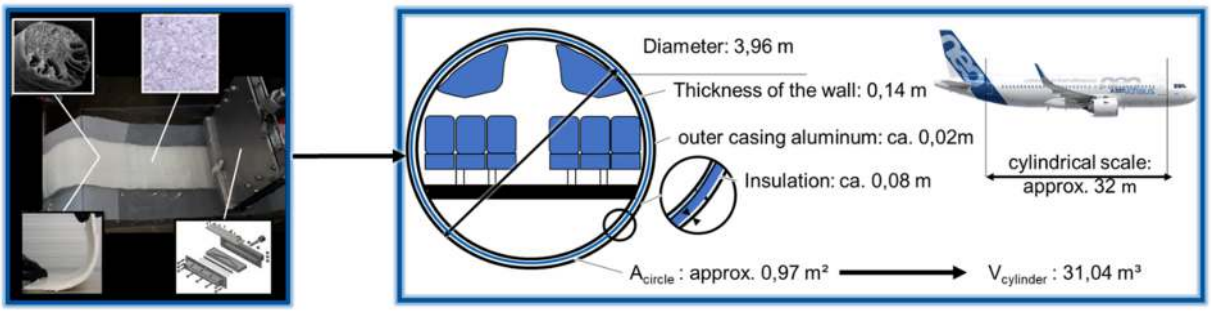

Figure 1: Form technical scale up to industrial application.

Acknowledgements

Authors are thankful to the Federal Ministry for Economic Affairs and Energy (BMWi, Germany) for the founding of the project EvA (FKZ 19U14008D) – “Efficiency-optimized combustion engine drive unit for the cold start, start/stop and hybrid operation” and the further project Chrysomallos (FZK 20E1906) “Development of high-performance insulators for aircraft cabins based on Aerogel nonwovens” and all integrated partners like Institute of Structural Mechanics and Lightweight Design (SLA), Aerogelex, ElringKlinger AG, NANO-X GmbH and ElringKlinger Motortechnik GmbH.