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Project Title:	Chrysomallos: Development of high-performance insulators for aircraft cabins based on aerogel nonwovens
Partners:	Institut für Strukturmechanik und Leichtbau of RWTH University Aachen Institut für Textiltechnik of RWTH Aachen University
Duration:	01.07.2020 – 31.12.2022
Conveyor:	Luftfahrtforschungsprogramms LuFo VI - 1

Mission Statement

The Chrysomallos project is developing a high-performance insulator for aircraft cabins based on aerogels. This insulator has the same insulating capacity but a significantly lower weight than the previously used glass fiber mats and solves the problem of the previously high production costs of aerogels. The widespread use of aerogel materials is not possible due to high production costs and poor mechanical properties. The main problems are their mechanical brittleness and the energy and time consuming manufacturing process. With the same insulation capacity, aerogels can save half the space and weight compared to conventional insulation. However, the cost of producing aerogel is many times higher than that of conventional insulation materials. Even vacuum insulation panels can be produced at lower costs than conventional aerogels. A promising approach is the manufacturing process of aerogel fleece to be developed in the project described here. In addition to the increased flexibility of the nonwovens compared to monolithic aerogel material due to their textile structure, a significant cost reduction in the production of the nonwovens can be expected. By replacing the glass fiber mats used today with an insulator with equivalent thermal insulation properties and lower density, costs in flight operations can be saved. The resulting economic potential can be estimated using the Airbus A320 family as an example. By switching to the better and lighter insulation material in these aircraft, the total mass can be reduced by about half a ton. The weight saving leads to reduced kerosene consumption and thus to ecologically and economically more efficient flight operations.

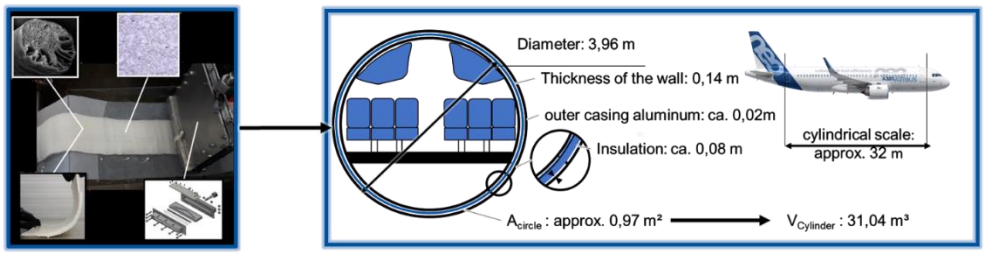

Figure 1: From the pilot plant to industrial design

Economical Relevance

The aim of the project is to develop an insulation material with reduced density (reduction >20 %). For this purpose, a novel insulation based on aerogel is to be developed. The basis is an already developed aerogel fleece (0.06 W/mK at 28 kg/m³) based on a dissertation at the Institute of Textile Technology of the RWTH Aachen University (Mroszczok, J.: 2019). The existing plant technology is being further developed to further improve the properties of the nonwoven. Among other things, the diameters of the aerogel fibers are to be reduced and their nanostructure optimized by adapting the production conditions. The produced fibers and nonwovens will be characterized especially with regard to their thermal conductivity and density. For this purpose, a test rig will be set up which can measure the thermal conductivity of both fibers and nonwovens. With this data the nonwovens can be digitally reproduced (digital twin), which allows the design of the insulation materials. The results of the design are finally used for the production of Aerogel nonwoven demonstrators to compare them with conventional glass fiber insulation mats. Parallel to this, a simulated comparison of aerogel nonwovens equipped with aerogel fleece and conventionally insulated airplanes is carried out.

Literature

[MJ19] Mroszczok, J.:
Herstellung von Aerogelvlies, Dissertation, ISBN: 978-3-8440-6726-2, 2019

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