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Title: Cellulose aerogel nonwovens - Sustainable insulators of tomorrow

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Highly efficient insulators made from sustainable materials are necessary to achieve the climate protection goals of the Paris Climate Agreement. Aerogels can serve the requirements of efficient insulation. In combination with cellulose as a sustainable, renewable raw material, they are perfectly suited for meeting the climate protection objectives. Aerogels made from cellulose can be made as nonwoven which results in a flexible textile and avoid the brittleness of most monolithic aerogels. They are particularly suitable as lightweight insulators regarding their acoustic and thermal properties. This allows cellulose aerogel nonwoven insulators to be used in a variety of applications, from aerospace to mobility but also in construction.

Aerogels are characterized by their low density and low thermal conductivity. The low thermal conductivity is a result of the nano porous structure, which triggers the Knudsen diffusion and minimizes heat transfer by diffusion. According to the Knudsen diffusion, the molecules are more likely to collide with the pore walls than with other molecules. As a result, a large part of their energy is transferred into the skeletal structure and will not be transferred further. Aerogels can be up to 99 % air, and the skeletal structure can be made of a wide variety of materials, including cellulose.

Aerogels can be produced in different monolithic shapes, but also as fibers. While monolithic aerogels are very brittle, aerogel filaments are superior in terms of flexibility and drapability. However, aerogel nonwovens are still inferior in terms of thermal conductivity. Cellulose aerogel fibers and nonwovens have already been successfully produced at the Institute of Textile Technology at RWTH Aachen University (ITA). The nonwovens are directly prepared by a wet-spun-laid process and need only supercritical drying to solidify the aerogel structure before usage.

Further investigations are currently being carried out at ITA. After the proof of concept regarding the cellulose aerogel fiber production, in further steps the effect of the solvent, as well as the choice and composition of the coagulation bath on the development of the nanopore structure will be investigated.

This presentation will provide an insight in our research regarding the innovative cellulose aerogel material and why cellulose aerogel nonwoven insulators are perfect for tackling the climate protection objectives.