

Energieeffizientes textiles Bauen mit transparenter Wärmedämmung für die solarthermische Nutzung nach dem Vorbild des Eisbär-Fells - Eisbärbauten

Förderkennzeichen: UT 050

Textile structures such as stadium roofs, airport and railroad station roofs, air-inflated marquees, and tents are built with coated fabrics or films that have no thermal resistance and, thus, are not suited for use in air-conditioned interior space. The results of the project contribute to considerably improving the energy balances of textile structures as regards the design and layer composition of the textile covers, components for energy production through controlled and active regulation of the gas in the space between the textile layers, and seasonal energy storage. Modeled on the solar-thermal functions of polar bear fur, a translucent multilayer summer/winter thermal insulation system suited both for cantilever structures with span lengths of up to 10 m and for freely formed curved planes was developed. The energy transport in the space between the upper and the lower space-enclosing textile layers was investigated to be able to determine the energy gain and couple it with suitable heat storage systems and systems for energy conversion or storage. The project tasks included the development and design of the respective layers, the manufacture of the textile composite materials for construction of the envisaged demonstration object, the determination of load transfer material parameters such as strength, axial rigidity and tear propagation behavior, the assessment of structural-physical parameters such as heat transfer, reflection and absorption for UV, VIS, and IR, the structural design of layers, and the gas-tight bonds between the layers, at edges, and at joints of rigid components under aspects of efficient construction. The entire gas distribution system for energy production, the respective components, and the heat storage system were developed and validated using demonstration objects. New simulation tools for energy production, energy storage, and textile-building air conditioning were developed for that purpose. Proving that also translucent lightweight buildings can have energy balances that come up to today's demands on resource-saving building construction, the results obtained will give an impulse for textile construction.