

Functional coatings on ETFE films for membrane architecture

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Pneumatic ETFE cushions in membrane architecture are highly attractive products. The energy efficiency of membrane buildings, however, is typically poor compared to state-of-the art wall or fenestration systems. Functional coatings such as low-e or solar control coatings can help to increase energy efficiency significantly, but until now, no transparent functional coatings on ETFE film are commercially available. Such coatings need to withstand the ambient conditions in the cushions, such as high humidity, high temperatures, high UV-radiation and mechanical elongation as well as have a good mechanical resistivity during manufacturing and installation.

Thermal simulations were carried out to define relevant optical target values of low-e and solar control coatings. The influence of the coatings on energy consumption of reference buildings was studied.

The layer configuration of low-e coatings and solar control coatings follows the general principle comprising sputtered silver and several adhesion and barrier layers, but adds a protective coating on top, which improves the stability significantly. Both the sputtered layer stack and the protective coating were optimized regarding stability and optical characteristics.

Typical samples of a low-e coating on ETFE show a visual transmittance of 70 % and thermal emittance of 25 %, without changing their performance after exposure to 85 °C and 85 % relative humidity for 30 days. Further stability tests involve UV, condensation, mechanical elongation, resistance to different solutions and abrasion.

The production process was upscaled at two production lines, a sputter coater and a lacquer coater and different coils of 1200 mm width and 400 m length were produced and a 1m*1m demonstrator was built.