

Coating of ETFE – solar shading for architectural applications

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Abstract

In 1982 the first building to be clad with an ETFE (ethylene tetrafluoroethylene) foil system was completed for the Burger's Zoo in Arnhem, The Netherlands. One of the principle characteristics of ETFE is high transparency across the entire solar spectrum from UV light (280 nm – 380 nm) over visible light (380 nm – 780 nm) to near IR radiation (780 nm – 3000 nm). This performance is ideal for provision for plant growth resulting in transmission of nearly 90 % of photosynthetically active radiation (PAR). For human habitats the broad band high transmission rate may result in heating up of inside areas, thus enhancing the energy consumption required for air conditioning. In order to enhance user comfort and reduce cooling loads the foils have to be specially treated or coated. ETFE foils have a low surface energy (23 mN/m) which inhibits surface adhesion offering maintenance advantages from self-cleaning effects but presenting considerable challenges for the design and application of stable coatings. Additionally, when installed as a building cladding system ETFE foils undergo significant in-service deformation, both plastic and elastic, as result of designed stabilising pre-stress and in response to dynamic environmental loadings. Plastic deformation is an additional safety factor for ETFE cushion cladding systems. Corresponding serviceability limit states (SLS) as well as ultimate limit states (ULS) are currently under discussion in the norm committee for a European standard for membranes and foils, CEN/TC 250 Structural Eurocodes, WG 5 Membrane Structures [1]. Coatings have to cope with this specific performance. A well-balanced relation between adhesion and cohesion is a fundamental requirement. The pigments have to remain stable on the foil surface even under conditions of multiple cyclic deformation in the range of both elastic and plastic deformation due to short term but high blast loads. This article will provide a brief introduction into the development of coating and printing on ETFE in particular, as well as an introduction into different techniques for solar shading of ETFE cladding systems in architectural buildings. In order to allow for quality assessment of these coatings taking into account elastic and plastic deformation of the target material, a new test procedure for coated ETFE will be introduced.

References

- [1] N. Stranghöner, J. Uhlemann et.al., Prospect for European Guidance for the Structural Design of Tensile Membrane Structures, *JRC Report: Eurocodes Scientific and Technical Report*, Publications Office of the European Union, Luxembourg (2016).