

The Development of a Nanofiber Membrane for Outdoor and Activity Related Purposes

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Abstract : This paper describes the development of a nanofiber membrane for sport and outdoor use at the Technical University of Liberec (TUL) and the following cooperation with a private Czech company which launched this product onto the market. For making this membrane, Polyurethane was electrospun on the Nanospider spinning machine, and a wire string electrode was used. The created nanofiber membrane with a nanofiber diameter of 150 nm was subsequently hydrophobised using a low vacuum plasma and Fluorocarbon monomer C6 type. After this hydrophobic treatment, the nanofiber membrane contact angle was higher than 125°, and its oleophobicity was 6. The last step was a lamination of this nanofiber membrane with a woven or knitted fabric to create a 3-layer laminate. Gravure printing technology and polyurethane hot-melt adhesive were used. The gravure roller has a mesh of 17. The resulting 3-layer laminate has a water vapor permeability Ret of 1.6 [Pa.m².W⁻¹] (- measured in compliance with ISO 11092), it is 100% windproof (- measured in compliance with ISO 9237), and the water column is above 10 000 mm (- measured in compliance with ISO 20811). This nanofiber membrane which was developed in the laboratories of the Technical University of Liberec was then produced industrially by a private company. A low vacuum plasma line and a lamination line were needed for industrial production, and the process had to be fine-tuned to achieve the same parameters as those achieved in the TUL laboratories. The result of this work is a newly developed nanofiber membrane which offers much better properties, especially water vapor permeability, than other competitive membranes. It is an example of product development and the consequent fine-tuning for industrial production; it is also an example of the cooperation between a Czech state university and a private company.

Keywords : nanofiber membrane, start-up, state university, private company, product

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