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Composites of hydrophilic and hydrophobic fibers with controlled mechanical and wetting properties for water harvesting

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In our studies we investigated surface and mechanical properties of composites made of hydrophilic and hydrophobic electrospun fibers to water harvesting applications. As a hydrophilic polymer we used polyamide 6 (PA6) and hydrophobic polystyrene (PS).
Prior electrospinning PS was dissolved in dimethylformamide (DMF), at 25%wt. and PA6 in formic and acetic acids with ratio 1:1, 12%wt. The hydrophobic, PS and hydrophilic, PA6 composites were produced using two nozzles electrospinning setup (Apparatus EC-DIG with Climate-control, IME Technologies, the Netherlands). Fibers were electrospun layer by layer and hydrophilic and hydrophobic parts were controlled with the deposition time. Fibers morphology and sizes were analyzed by scanning electron microscope (SEM, Merlin Gemini II, ZEISS, Germany). Water contact angle was measured in horizontally and vertically on produced fibers and composites. The mechanical properties were verified using tensile module with 1 N Load Cell (Kammrath Weiss GmbH, Germany). Prior the mechanical testing the thickness of the sample was measure with versatile digital microscope DinoCapture 2.0 (Dino-Lite Europe/IDCP B.V., The Netherlands)
The water contact angle measured horizontally for PS fibers was 142 $\pm$ 2o, whereas for PA6 was 45 $\pm$ 2o. For the composites, the water contact angle was decreased up to 123 $\pm$ 2o with the increase of PA6 fraction. Simultaneously, this composite had the best mechanical properties. Additionally, the wetting experiment in vertical settings showed possibility to collect water in very effective way. Composites combine hydrophobic and hydrophilic fibers show great possibility to be applied in fog collectors to increase the potential of catching larger fraction of rain and fog droplets.