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Unidirectional water transfer effect from fabrics having a superhydrophobic-to-hydrophilic gradient
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Abstract: In this study, we demonstrate that fabrics having a wettability gradient from superhydrophobic to hydrophilic through the thickness direction show a novel directional water transfer effect: water can transfer from the superhydrophobic to the hydrophilic side, but not in the opposite direction unless an external force is applied. A sol-gel technology was used to prepare a nano-structured superhydrophobic coating on fabrics, and the coated fabrics showed water contact-angle as high as 165 degrees. When the coated fabric was subjected to a photochemistry treatment from one fabric side, the irradiated surface turned hydrophilic permanently, while the back side still maintained the superhydrophobicity. The treated fabric can transfer water droplet rapidly from hydrophobic to hydrophilic side, and the pressure allowing water breakthrough the fabric are different considerably between the two fabric sides. The directional water transfer effect is affected by the wettability gradient. Such a directional water transfer coating may be useful to develop new functional fabrics for defence applications.