

Abstract Submitted
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One-way water permeable valve via water-based superhydrophobic coatings JOSEPH E. MATES, CONSTANTINE M. MEGARIDIS, Mechanical and Industrial Engineering, University of Illinois at Chicago — Spray-cast superhydrophobic coatings have shown promise in commercial applications for fluid management due to their intrinsic low-cost, large-area capabilities and substrate independence (Schutzius et al. 2011). A technique of applying a light ($< 2\text{gsm}$) water-based superhydrophobic coating on inherently hydrophilic cellulosic substrates to generate a preferred directionality for water absorption and transmission is presented. The mechanism described allows water to pass through a thin treated porous substrate in one direction under negligible pressure, but does not allow water to return from the opposite direction unless much greater pressure is applied. This pressure disparity “window” effectively creates a one-way fluid valve, with envisioned applications ranging from personal hygiene products, to oil-water separation and filtration. Combining SEM imaging with theoretical robustness factors (Tuteja et al. 2008), the penetration pressures are found to be tunable for application-specific designs by choosing a substrate based on limiting factors of fiber diameter and spacing. The process can also be modified with the addition of functionalized (e.g. antibacterial, conductive) nanoparticle fillers suited for the desired application.

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