Chemical & Environmental Engineering

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Modification of Paper/Cellulose Nanostructure to Control Water Droplet Adhesion and Transport

Cellulose is a biodegradable, renewable, flexible, inexpensive biopolymer that is abundant in nature. However, due to its hydrophilicity, application of cellulose (paper) to the handling of aqueous fluids is severely limited. Appropriate plasma- or glow discharge-assisted processing sequences permit the surface of cellulose/paper to be modified so that the interaction of water with these surfaces can be altered. In particular, specific nanostructures associated with crystalline regions of cellulose fibers can be formed by plasma-enhanced etching; subsequent plasma-enhanced fluorocarbon film deposition (~100 nm) converts the surface into a superhydrophobic (contact angle >150°) state. Depending upon the etch cycle, the paper surface can be rendered 'roll-off' or 'sticky' superhydrophobic; in this way, droplet mobility can be controlled. Use of a commercial printer to generate hydrophobic ink patterns on superhydrophobic paper surfaces allows controlled movement, transfer and storage of water or other aqueous fluids on the paper surface. Such basic functionalities can be combined to design a simple two-dimensional lab-on-paper (LOP) device.

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Friday March 12, 2010
9:30 - 10:30 AM
Bourns Hall A265
Refreshments at 9:15 AM