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Fiber network with superhydrophilic Si-DLC coating

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The high capillarity of a plastic fiber network having superhydrophilic Si-DLC coating is studied. Although the superhydrophilic surface maximize wetting ability on the flat surface, there remains a requirement for the more wettable surface for various applications such as air-filters or liquid-filters. In this research, the PET non-woven fabric surface was realized by superhydrophilic coating. PTE non-woven fabric network was chosen due to its micro-pore structure, cheap price, and productivity. Superhydrophobic fiber network was prepared with a coating of oxgyen plasma treated Si-DLC films using plasma-enhanced chemical vapor deposition (PECVD). We first fabricated superhydrophilic fabric structure by using a polyethylene terephthalate (PET) non-woven fabric (NWF) coated with a nanostructured films of the Si-incorporated diamond-like carbon (Si-DLC) followed by the plasma dry etching with oxygen. The Si-DLC with oxygen plasma etching becomes a superhydrophilic and the Si-DLC coating have several advantages of easy coating procedure at room temperature, strong mechanical performance, and long-lasting property in superhydrophilicity. It was found that the superhydrophobic fiber network shows better wicking ability through micro-pores and enables water to have much faster spreading speed than merely superhydrophilic surface. Here, capillarity on superhydrophilic fabric structure is investigated from the spreading pattern of water flowing on the vertical surface in a gravitational field. As water flows on vertical flat solid surface always fall down in gravitational direction (i. e. gravity dominant flow), while water flows on vertical superhydrophilic fabric surface showed the capillary dominant spreading.