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Water droplet spreading and imbibition on superhydrophilic poly(butylene terephthalate) melt-blown fiber mats

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Abstract

Water droplet spreading and imbibition on alkaline hydrolyzed melt-blown poly(butylene terephthalate) (PBT) fiber mats is studied with both experiments and numerical simulations to elucidate the influence of surface hydrolysis. Melt-blown PBT fiber mats were exposed to a NaOH-methanol solution for controlled periods of time, resulting in surface hydrolysis of the fiber mats and the transformation of their surface wetting properties from hydrophobic to superhydrophilic. Visualization experiments reveal the influence of the hydrolysis time on the rate of droplet absorption by superhydrophilic hydrolyzed PBT fiber mats, and are used to characterize droplet spreading and imbibition. A mathematical model was employed to understand the observed spreading and imbibition behavior and the lower effective permeability seen for long hydrolysis times.