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The hydrodynamics of ink writing JUNG CHUL KIM, HO-YOUNG KIM, Seoul National University — When one writes on the paper with a pen, the ink spreads on the porous hydrophilic solid surface leaving a trail whose width depends on the pen speed and the physicochemical properties of the ink and of the paper. Here we mathematically describe the spreading profile of the ink, which is modeled to be a liquid from a tube wicking through a rough hydrophilic surface (micropillar arrays). By balancing the capillary forces that drive the liquid flow with the viscous forces exerted by the forest of micropillars, we obtain the rate of ink spreading. Considering the liquid spreading and the pen translation that occur simultaneously, we predict the frontal shape and the final width of a line that is drawn by the pen. We performed experiments using various kinds of liquids and different dimensions of micropillar arrays that are coated with Si-DLC film and treated with oxygen plasma. The theory and experiment are shown to be in excellent agreement.

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