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Droplet Impact and Penetration on a Series of Capillary Tubes SAMAN HOSSEINI, ALIREZA DALILI, NASSER ASHGRIZ, SANJEEV CHAN-DRA, University of Toronto — A series of experiments were carried out in which a single droplet of water was deposited onto a substrate having a series of closely spaced parallel-holes to represent a simple porous media. At the center of the width of the 0.6"x0.5"x0.3" poly-carbonate substrate seven through-holes each with a diameter of 300 μ m and distance of 300 μ m from one another were drilled in a straight line. Droplets with diameters of 3.2 and 2.0 mm were released from heights of 1, 3 and 5 cm. Using a high-speed camera the impact, spreading and capillary penetration of the droplets into the holes were videotaped. Two different penetration regimes were observed based on the impact velocity. At low droplet impact velocities, the penetration was mainly due to capillary forces, while at higher impact velocities the penetration occurred at two stages. The first stage was inertia driven, while the second stage was capillary driven penetration. The threshold velocity for liquid penetration into the holes was formulated. Inertia forces were used to describe the linear portion of penetration and the Lucas-Washburn equation was used to characterize the non-linear (capillary) part of penetration. The distance of penetration as a function of time was worked out using this equation. Droplet oscillation on the top of the parallel holes was observed as well. It was evident that the area of the penetration inside the holes played a major role in the kinetic energy dissipation and the damping of the oscillation.

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