Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Dynamics of liquid imbibition through paper fibers with intra-pores[1] SOOYOUNG CHANG, JAEDEOK SEO, SEOKBIN HONG, Sogang Univ, DUCK-GYU LEE, Korea Institute of Machinery Materials, WONJUNG KIM, Sogang Univ — The accurate control of liquid imbibition in paper is crucial for the applications of paper to microfluidic devices. However, the classical model for capillary flow in porous media, Lucas-Washburn law, has limitations in predicting the flow in a complex fiber network such as paper. We here report that intra-fiber pores in paper are mainly responsible for the limited accuracy of the previous model. From our experiment, we observed that liquid may imbibe through intra-pores in cellulose fibers as through the pores formed by fiber network. We experimentally measured the flow rate through the intra-pores and theoretically developed a hydrodynamic model for liquid imbibition through paper fibers with intra-pores. Our theoretical predictions are shown to agree well with experimental observations, leading to the physical reasons behind the limits of Lucas-Washburn law.

[1]This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (No.2015R1A2A2A04006181).

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Date submitted: 29 Jul 2016 Electronic form version 1.4