Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Colloidal Drop Deposition on Porous Substrates[1] YING SUN, MIN PACK, HAN HU, DONG-OOK KIM, XIN YANG, drexel university — Printable electronics and in particular paper and textile-based electronics have fueled research in inkjet printing on porous substrates. On nonporous substrates, the particle motion of the particles and evaporation of the solvent are the two main mechanisms that drive the final deposition morphology. For porous substrates another factor, mainly infiltration, adds a layer of complexity to the deposition patterns that has not yet been elucidated in literature. In this study, a high-speed camera was used to capture the imbibition of picoliter-sized polystyrene nanoparticles in water droplets into nano-porous anodic aluminum oxide substrates of various porosities and wettabilities. For water, the infiltration rate is much faster than both evaporation and particle motion and thus when the substrate fully imbibes the droplet, the well-known "coffee ring" is suppressed. However, when a residual droplet forms upon the termination of the infiltration regime, the competing particle motion and evaporation regimes, t_{P}andt_{EI} respectively, define the critical time scales for which the coffee ring will be formed ($t_{\mathrm{P}}/t_{\mathrm{EI}}<1$) or suppressed ($t_{\mathrm{P}}/t_{\mathrm{EI}}>1$).

[1]National Science Foundation under Grant No. CMMI-1401438.

Min Pack
Drexel Univ

Date submitted: 31 Jul 2015 Electronic form version 1.4