Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Transport and Deposition of Electrosprayed Nanoparticles NICHOLAS BROWN, PAUL CHIAROT, SUNY Binghamton — In an electrospray, high electric potentials are utilized to generate a fine aerosol of a conductive solvent. For this study, the solvent consisted of nanoparticles dispersed in alcohol. The nanoparticle suspensions act as printable nanoparticle inks. In this process, a glass capillary tube is held as a high electric potential relative to a grounded reference plate located below the tip. Droplets are ejected from the tube and are directed towards the ground plate. If the solvent is sufficiently volatile, it will rapidly evaporate while the droplets are in flight (due to the high surface area to volume ratio) leaving behind dry, highly charged nanoparticles. The droplets/nanoparticles are deposited onto a target substrate that is place onto the grounded plate. The transport of any individual droplet/nanoparticle from the emitter tip to the target substrate is a stochastic process. This transport can be modeled using a Monte Carlo simulation. The probability of an individual particle being deposited at a given location on the target substrate is directly related to the electric potential at that location. In other words, the probability function that determines the deposition is directly related to the electric potential at the substrate. The total potential is comprised of the applied electric potential required to generate the electrospray, the induced charge on the surface of the target dielectric, and the charge on the individual particles themselves. We report on the structure of droplet/nanoparticle deposits printed using electrospray. The evolution of the deposit is investigated over time using experimental studies and Monte Carlo simulations. The deposit structure passes through four distinct regimes that are characterized by repeatable bulk features.

Nicholas Brown
SUNY Binghamton

Date submitted: 01 Aug 2015 Electronic form version 1.4