

MODELING INK TRANSPORT IN A NANO FOUNTAIN PEN

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The Nano Fountain Pen (NFP, Figure a, b) is now being used to create protein and DNA arrays, investigate nanomaterial-mediated cancer drug delivery, and build large-scale arrays of carbon nanotube-based devices. These achievements are possible through the use of liquid molecular “inks” like solutions of protein, DNA, gold nanoparticles or cancer-drug-coated nano-diamonds.

The understanding of the mechanisms by which molecules are transported to the substrate and the parameters that dictate the resolution of the NFP writing is an especially important aspect of this work. To gain insight into the deposition process, a numerical study of the equilibrium ink-air interface was conducted. The flow of ink was modeled to determine the equilibrium shape of the ink surface for a series of prescribed volumes. This work revealed the need for an electric field to pattern proteins. By observing the effect of various patterning parameters (e.g., ambient humidity), conditions can now be optimized to achieve the best possible resolution and writing efficiency.

