

Nanostructure Fabrication Using Dip-pen Nanolithography

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The ionic layer-by-layer (LBL) assembled films, introduced by Decher, have been widely studied because of their potential applications in electronic materials such as photovoltaics and electrochromic thin films, as well as biological studies for templating cells and incorporating proteins. These organic LBL films, which are often referred to as polyelectrolyte multilayer (PEM) films, can be formed by sequentially immersing substrates into solutions of oppositely charged polyions. The ease of use of the LBL methodology in the assembly of charged polymers offers one the ability to tailor important parameters such as film thickness at the nanometer-scale and the chemical functionality of the top most layer of the PEM films. Indeed, micro-scale techniques for fabricating LBL structures using photolithography or micro-contact printing are well-established. Developing such capabilities for DPN not only would allow one to significantly reduce feature size but also allow one to build chemically distinct LBL features on the nanometer length scale. Through the use of multiple pen arrays, we demonstrate, for the first time, the parallel writing capabilities of DPN in the context of this LBL patterning experiment.