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Electric Field-Assisted Dip-Pen Nanolithography on P4VP Polymer Films XIAOHUA WANG, SUJI UPPALAPATI, XIN WANG, RODOLFO FERNANDEZ, MINGDI YAN, ANDRES LA ROSA, Portland State University — Dip-Pen Nanolithography (DPN) has attracted increased attention in recent years for its ability to generate nanometer-scale patterns on solid surface using an 'ink'-coated atomic force microscope (AFM) tip. Herein we develop a modified DPN modality for creating nanostructures on Poly(4-vinylpyridine) (P4VP) polymer film, which exploits the mechanical swelling response of the substrate. The underlying working principle consists in delivering acidic ions onto polymer films to very locally trigger the protonation of the polymer film, causing the latter to swell. An AFM tip coated with phosphate buffer solution of pH 4 is used for the patterning process. More importantly, a reliable strategy results when applying an electric field between the AFM tip and polymer substrate to control the protonation process. We demonstrate the capability of the electric field-assisted DPN technique for reproducibly and reliably fabricating nanostructures originated from the swelling response of P4VP polymer. Our study includes a systematic pattern fabrication under different pattering parameters (applied bias and contact force), and provides evidence on the reversible character of the process.

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