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Molecular Transport in Dip-Pen Nanolithography of Alkanethiols on Gold PETER SCHWARTZ, Cal Poly Physics Dept., San Luis Obispo, ERIK PETERSON, Cal Poly Chemistry Dept. San Luis Obispo, IVAN HROMADA, MATTHEW LEYDEN, JAMIE ROMNES, Cal Poly Physics Department, San Luis Obispo, BRANDON WEEKS, Texas Tech Chemical Engineering Dept., CAL POLY PHYSICS DEPT. TEAM, CAL POLY CHEMISTRY DEPT. TEAM, TEXAS TECH UNIVERSITY TEAM — The direct patterning of Octadecanethiol (ODT) and mercaptohexadecanoic acid (MHA) from an AFM tip by Dip-Pen Nanolithography (DPN) is investigated as a function of humidity, temperature, total elapsed time, and protocol for coating the AFM tip, and the process is directly observed by scanning electron microscopy (SEM). Rather than being independent of AFM tip speed, the molecular transport rates of ODT and MHA decrease for slower AFM tip translation rates, consistent with Fickian Diffusion. Both molecules can be patterned under a dry atmosphere in apparent absence of a water meniscus and exhibit Arrhenius temperature dependence, consistent with a "dry patterning" process driven by thermal motion. Unlike ODT, the molecular transport rate of MHA both decreases over time in a near exponential fashion with an approximately 1-hour decay time, and substantially increases at very high relative humidity indicating that MHA transports my means of both dry patterning as well as solvation in a water meniscus. SEM results indicate that surface characteristics strongly affect the presence of a meniscus.

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