Abstract Submitted
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Nanometer-scale free surface flow of molten polyethylene from a heated atomic force microscope tip RANDY EWOLDT, JONATHAN FELTS, SUHAS SOMNATH, WILLIAM KING, Department of Mechanical Science and Engineering, University of Illinois Urbana-Champaign, Urbana, IL 61801, USA — We experimentally investigate nanometer-scale free surface flow of molten polyethylene from a heated atomic force microscope (AFM) cantilever, a nanofabrication process known as thermal dip-pen nanolithography (tDPN). Fluid is deposited from the AFM tip onto non-porous substrates whether the tip is moving or fixed. We find that polymer flow depends on surface capillary forces and not on shear between tip and substrate. The polymer mass flow rate is sensitive to the temperature-dependent polymer viscosity. Additionally, the flow rate increases when a temperature gradient exists between the tip and substrate. We hypothesize that the polymer flow is governed by thermal Marangoni forces and non-equilibrium wetting dynamics caused by a solidification front within the feature.

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