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Measurement advances to follow polymer thin film reaction-diffusion processes. VIVEK PRABHU, SHUHUI KANG, KRISTOPHER LAVERY, NIST, KWANG-WOO CHOI, NIST, Intel Corp., WEN-LI WU, ERIC K. LIN, NIST — Polymer thin films are used as imaging layers for photolithography to define high spatial resolution features for the semiconductor industry. These chemically amplified photoresist materials, however, may be reaching their intrinsic limits as desired feature sizes approach macromolecular dimensions. A photoacid-catalyzed reaction defines a chemical image which is subsequently resolved by dissolution in an aqueous base solution. A method to characterize the reaction-diffusion process was developed using infrared spectroscopy and tested by neutron reflectivity. We determine the thin film reaction kinetics, photoacid trapping behavior, and photoacid diffusivity by measuring the reaction kinetics. The temperature-dependence and mechanism for observed pinning of the reaction-diffusion front will be discussed. These results permit an analysis of the latent image formation which is a crucial for photolithography resolution and fidelity.

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