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Acid Diffusion in a Reacting Polymer Glass ABHIJIT PATIL, GINUSHA PERERA, YOGENDRA PANDEY, MANOLIS DOXASTAKIS, GILA STEIN, Dept of Chemical Engg, University of Houston — The acid-catalyzed deprotection of glassy polymer films is an important process in photolithography. It is well-established that acid diffusion controls the deprotection kinetics, but simple Fickian transport models cannot capture experimental data. We examined the acid-catalyzed deprotection of a glassy poly(4-hydroxystyrene-co-tertbutylacrylate) resin using infrared absorbance spectroscopy and stochastic simulations. Experimental data were interpreted with a model that explicitly accounts for acid transport, where heterogeneities at local length scales are introduced through a non-exponential distribution of waiting times between successive hopping events. Subdiffusive behavior predicts key attributes of the observed deprotection rates, such as fast reaction at short times, slow reaction at long times, and a non-linear dependence on acid loading. These studies suggest that macroscopic deprotection rates are controlled by a strongly non-Fickian acid transport in the glassy polymer resin.

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