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Microwave-Assisted Surface-Initiated Free Radical Polymerization ERICH BAIN, XINFANG HU, CHRISTOPHER GORMAN, JAN GENZER, North Carolina State University — We investigate microwave (μw) irradiation as a heat source for surface-initiated (SI) free-radical polymerization (FRP). First, we consider the possibility of SI controlled radical polymerization (CRP) without chemical additives, based on local heating due to microwave absorption by the substrate. A simple model is developed to predict the temperature gradient at the interface between a microwave absorbing substrate and a nonabsorbing medium. Stochastic simulations are then applied to predict the molecular weight distribution for polymerizations with decoupled kinetics of initiation, propagation, and termination due to the temperature gradient. The simulations shed light on experimental requirements for μw-induced SI-CRP, as well as general conditions for any successful CRP. Secondly, we consider whether μw irradiation may increase throughput of SI-FRP, affording either faster brush growth, thicker brushes, or both, compared with conventional heating (CH) (e.g. by an oil bath). Experimental results of μw SI-FRP are compared against CH on silicon wafers, quartz slides, particles, and in bulk. Reproducibility of heating for silicon wafers is found to depend on orientation relative to the incident irradiation.

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