

350g Experimental and Theroretical Investigation of Multicomponent Solvent Removal from Semicrystalline Polymers

Sim-Siong Wong, Sacide Alsoy Altinkaya, and Surya K. Mallapragada

Mathematical models have been developed to study the diffusion of multiple solvents and changes in the crystallinity of semicrystalline polymer films during drying. The model incorporates many features including Vrentas-Duda diffusion model, solvent-induced crystallization kinetics, as well as glass transition effects and skinning of the film. We are establishing experimental techniques to complement our model toward developing a better understanding of the drying phenomena in semicrystalline polymers. The change of crystallinity of poly(vinyl alcohol) in the presence of water and methanol was observed using infrared spectroscopy and independently verified using differential scanning calorimetry. The composition of methanol and water within the film was tracked during drying using FT-IR and compared with simulation results. The development of a glassy skin limits the diffusion of solvents out of the system, effectively trapping the solvent in the film. This effect could be minimized by employing a multi-zone drying scheme to selectively remove a specified solvent at each drying zone, and monitored using thermogravimetric methods.