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Numerical Modeling of Nanocellular Foams Using Classical Nucleation Theory and Influence Volume Approach IRFAN KHAN, STEPHANE COSTEUX, SHANA BUNKER, JONATHAN MOORE, KISHORE KAR, The Dow Chemical Company — Nanocellular porous materials present unusual optical, dielectric, thermal and mechanical properties and are thus envisioned to find use in a variety of applications. Thermoplastic polymeric foams show considerable promise in achieving these properties. However, there are still considerable challenges in achieving nanocellular foams with densities as low as conventional foams. Lack of in-depth understanding of the effect of process parameters and physical properties on the foaming process is a major obstacle. A numerical model has been developed to simulate the simultaneous nucleation and bubble growth during depressurization of thermoplastic polymers saturated with supercritical blowing agents. The model is based on the popular "Influence Volume Approach," which assumes a growing boundary layer with depleted blowing agent surrounds each bubble. Classical nucleation theory is used to predict the rate of nucleation of bubbles. By solving the mass balance, momentum balance and species conservation equations for each bubble, the model is capable of predicting average bubble size, bubble size distribution and bulk porosity. The model is modified to include mechanisms for Joule-Thompson cooling during depressurization and secondary foaming. Simulation results for polymer with and without nucleating agents will be discussed and compared with experimental data.

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