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A Multi-Scale Computer Model for Simulating Polymeric Foaming Processes QUAN YUAN, ASJAD SHAFI, AVINASH KHOPKAR, The Dow Chemical Company — Polymeric foams have many industrial and household applications. Their final properties depend upon the nature of the polymeric material and the cell size distribution. Industrial foaming process involves simultaneous complex multi-scale physical and chemical phenomena. The industrial practitioners of polymer foams have predominantly taken the trial and error approach in the past for process design and improvement. In the present work, a multi-scale foam model was developed to simulate foaming flows. Sub-grid models were developed to model nucleation, bubble-scale mass and energy transfer, and bubble growth combined with the multiphase transport equations. The bubble size distribution is modeled using a population balance model by simulating the second and third order moments. The influence volume approach is employed to account for the growth competition between large and small bubbles and to take into account both the mass and momentum transfer limitations on the growth. The model output provides both the bubble-scale and bulk-scale information of the polymer foam such as the average bubble size, bubble number density, evolution of the foam front interface and foam mass density. Simulation results are discussed and compared with experimental data.

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