Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Using Improved Equation of State to Model Simultaneous Nucleation and Bubble Growth in Thermoplastic Foams IRFAN KHAN, STEPHANE COSTEUX, DAVID ADRIAN, DIEGO CRISTANCHO, The Dow Chemical Company — Due to environmental regulations carbon-dioxide (CO_2) is increasingly being used to replace traditional blowing agents in thermoplastic foams. CO_2 is dissolved in the polymer matrix under supercritical conditions. In order to predict the effect of process parameters on foam properties using numerical modeling, the P-V-T relationship of the blowing agents should accurately be represented at the supercritical state. Previous studies in the area of foam modeling have all used ideal gas equation of state to predict the behavior of the blowing agent. In this work the Peng-Robinson equation of state is being used to model the blowing agent during its diffusion into the growing bubble. 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 effect of the improved model on the bubble growth and foam properties are discussed.

Irfan Khan
The Dow Chemical Company

Date submitted: 01 Aug 2013 Electronic form version 1.4