

# Observations on Solubility and Diffusivity of Carbon Dioxide in thermoplastic Polymers in the Solid-State Microcellular Foaming Process

Vipin Kumar, PhD  
Department of Mechanical Engineering, University of Washington  
Seattle, Washington 98195  
Email: [vkumar@uw.edu](mailto:vkumar@uw.edu)

A critical step in the solid-state microcellular foaming process is impregnation of the polymer with the blowing agent, such as carbon dioxide. This is usually done in a pressure vessel in which the polymer sheet is placed under a high pressure, typically in the 1-6 MPa range. This step is normally carried out at room temperature. The rate of gas diffusion in the polymer, and the solubility of the gas in the polymer are two important parameters that determine the eventual success, or lack of it, in producing microcellular foams with a desired structure.

This presentation will review the solubility and diffusivity of carbon dioxide in a number of thermoplastic polymers such as polycarbonate (PC), polyethylene terephthalate (PET), polylactic acid (PLA) and acrylonitrile-butadiene-styrene (ABS). These polymers possess a wide range of molecular structure and physical characteristics, representing amorphous, semicrystalline, and blended polymers. The nature of interaction of carbon dioxide with these polymers is explored.