

# Confined Foaming of Polymers in Supercritical Carbon Dioxide

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Various applications utilize polymeric foams, from shoe soles in footwear, to scaffolds for tissue engineering and to materials for sound absorption or heat insulation. Foaming of polymers with carbon dioxide is becoming increasingly appealing as an environmentally friendly process. Foaming involves exposing a polymer to carbon dioxide at high pressures followed, typically, by a rapid depressurization which causes bubble nucleation and lead to pore formation. Pore formation and final morphology are influenced by the amount of carbon dioxide that is dissolved in the polymer and the associated changes in the properties of the polymer such as the viscosity or the glass transition temperature. Foaming can be carried out without restricting the boundaries (i.e., free-foaming) or in molds with defined boundaries (i.e., confined-foaming). In free-foaming, if the rise in the modulus and viscosity is not rapid and the polymer viscosity remains low during depressurization, carbon dioxide may escape prior to solidification. The end-result is poor degree of expansion. This becomes a challenge in foaming of thin films. We have developed special foaming molds with porous boundaries that would confine the polymer during foaming, and at the same time provide some degree of control on CO<sub>2</sub> escape during depressurization. In this poster we will compare the foaming of selected amorphous (i.e., poly(methyl methacrylate)), semi-crystalline (i.e., poly(epsilon caprolactone)) and rubbery (i.e., poly(ethylene-co-vinyl-acetate)) polymers in free-and confined modes.