Synthesis and Processing of Cross-Linked Copolymer Microspheres, Monoliths and Beads using Supercritical CO₂

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Carbon dioxide is an attractive solvent for polymer chemistry because it is inexpensive, non-toxic, and non-flammable.^{1,2} Unlike conventional liquid solvents, supercritical fluids (SCFs) are highly compressible and the density (and therefore solvent properties) can be tuned over a wide range by varying pressure. Moreover, SCFs revert to the gaseous state upon depressurization, simplifying the separation of solvent from solute and eliminating solvent residues. We have used carbon dioxide as a solvent for the preparation of non-porous polymer microspheres,^{3,4} well-defined porous monoliths⁵ and, more recently, porous polymer beads.⁶ In this paper, we will demonstrate that the unique variable density associated with supercritical fluids can be used to control the structure of these materials, in particular the degree of porosity and the pore size distribution.

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