SYNTHESIS OF POLYMERS IN SUPERCRITICAL CARBON DIOXIDE

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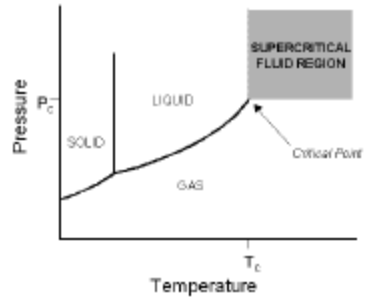

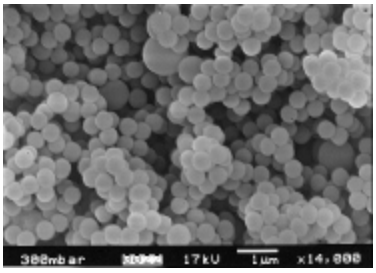

As society places increasing emphasis on environmental issues, chemists face the challenge of developing more responsible chemical methods, or 'green technology.' In the past, the polymer industry has used volatile organic solvents. Health risks and environmental problems have prompted legislation that sets strict emission levels, effectively prohibiting some solvents. We are interested in the use of carbon dioxide (CO_2) as an alternative solvent for polymer chemistry. In many respects, CO_2 is an ideal solvent choice because it is inexpensive, non-toxic, non-flammable, and chemically inert. At sufficiently high pressures and temperatures, CO_2 can exist as a *supercritical fluid* (see upper figure). In the supercritical state, CO_2 exhibits hybrid properties of a liquid and a gas. Like a liquid, it can be relatively dense and dissolve solutes, however like a gas, the fluid retains low viscosity, mixes with other gases, and is highly compressible. Since supercritical CO_2 can be compressed, one can 'tune' its density (and therefore its solvent properties) by varying the pressure. In addition, the solvent reverts back to the gaseous state upon lowering the pressure, thus allowing simple separation of solvent from solute and recycling of the gaseous CO_2. We are developing new methods for the synthesis of functional polymers in supercritical CO_2. The polymers can be synthesised in a variety of forms, such as highly porous continuous rods or non-porous, nanometre-sized, spherical particles (see lower figure). Our aim is to exploit the unique physical properties of the supercritical solvent to generate novel polymeric materials for a range of applications.