POLYMERISATION USING SUPERCRITICAL FLUIDS:
GREEN ROUTES TO SMART MATERIALS

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Synthetic polymers have found an enormous number of uses in modern society, ranging
from low-tech applications (e.g., cheap garden chairs) to decidedly high-tech inventions
(e.g., light emitting polymers for the next generation of flat screen displays). While many
people are aware of the problems caused by the large volumes of polymer waste that are
produced, rather less attention is given to the methods by which these polymers are
manufactured. In particular, polymer production is often accompanied by the use of large
volumes of organic solvents, most of which are highly damaging to the environment.

Our research in Liverpool has two main goals. Firstly, we are interested in developing methods for
the synthesis of polymers by more environmentally responsible methods. To do this, we are exploring
the use of carbon dioxide (CO$_2$) as a “green” solvent for polymer synthesis and processing. In many
ways CO$_2$ is an ideal solvent because it is non-toxic, non-flammable and inexpensive.
Under normal conditions CO$_2$ exists as a gas. However, at sufficiently high pressures,
the density of CO$_2$ becomes much higher and the gas starts to behave more like a liquid
solvent. By using CO$_2$ in this way, we hope to develop clean routes for polymer
synthesis. The second goal of our research is to synthesise “smart” polymers with
advanced physical properties (e.g., see microspheres in Figure). For example, smart
materials might be used in chemical separations or as catalysts (i.e., to make chemical
reactions occur faster or at lower temperatures). Our ultimate goal is a combination of
both strategies: to produce new smart materials through the use of alternative green
solvents.

For more details, see our web page at http://www.liv.ac.uk/Chemistry/Staff/coopera.html