Polymer Synthesis and Processing using Supercritical Carbon Dioxide

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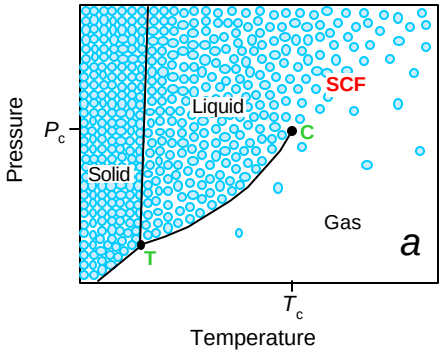
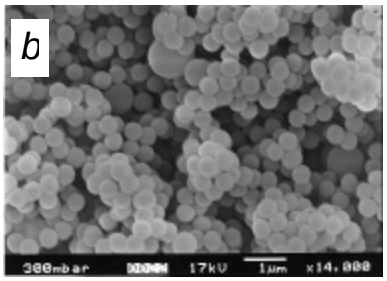


Carbon dioxide is a clean and versatile solvent for the synthesis and processing of a range of materials. This review [1] focuses on recent advances in polymer synthesis and processing using liquid and supercritical CO_2. The synthetic techniques discussed include homogeneous solution polymerisation [2], precipitation polymerisation [3], dispersion [4] and emulsion polymerisation [5], and bulk polycondensation [6]. The formation of porous polymers [7] and polymer blends [8] is also considered, and the specific advantages of CO_2 in these processes are evaluated in each case. The use of CO_2 as a solvent for polymer processing is reviewed from a materials perspective, with particular attention being given to the formation of polymers with well-defined morphologies. The variable solvent strength associated with supercritical fluids has been utilised in areas such as polymer fractionation and polymer extraction [9]. Plasticisation phenomena have been exploited for the impregnation [10] and heterogeneous chemical modification [11] of polymeric materials. The formation of microcellular polymer foams by pressure induced phase separation is considered [12], as is the use of CO_2 for polymer particle formation [13], spray coating [14], and microlithography [14,15]. The aim of the review is to highlight the wide range of opportunities available to the materials chemist through the use of carbon dioxide as an alternative solvent.



Figures: (*a*) Schematic pressure–temperature phase diagram for a pure component showing the supercritical fluid (SCF) region; (*b*) Cross-linked resin particles synthesised in supercritical CO_2 (scale bar = 1 μm), see ref. [4*c*,*d*].

References

1 This abstract is based on a Feature Article which will appear in the *Journal of Materials Chemistry*: A. I. Cooper, *J. Mater. Chem.*, 1999, *in press*.

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