POLYMERS, RENEWABLES AND SUPERCRITICAL CARBON DIOXIDE

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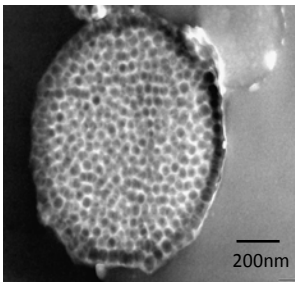
ABSTRACT

We have exploited the unique properties of $scCO_2$ to create novel polymeric materials in a clean, solvent free and energy efficient approach. The low viscosity and high diffusivity of $scCO_2$ allows dispersion polymerisation of a range of vinyl monomers to be effected with excellent control, leading to nanostructured microparticulate materials. By controlling the polymer block lengths and varying the monomer combinations we have demonstrated the ability to control the type of nanostructure obtained, and even to deposit guests. A high pressure $scCO_2$ small angle X-Ray scattering cell will also be described and using this we have begun to monitor the formation of the nanostructures *in-situ.*



Microparticle demonstrating the type of phase separated structures obtained by RAFT controlled dispersion polymerisation in $scCO_2$

We have also utilized the ability of $scCO_2$ to plasticise both monomers and polymers to effect polycondensation and ring opening polymerisations at much lower temperatures than is possible under conventional operating conditions. In some cases, these lower temperature operating conditions have opened up the opportunity to use enzymatic catalysts to yield valuable new polymeric materials. Finally, we will report on new approaches to creating polymers with a wide range of physical properties from waste materials such as terpenes.