P.47 Pickering emulsion by arresting phase separation using anisotropic particles

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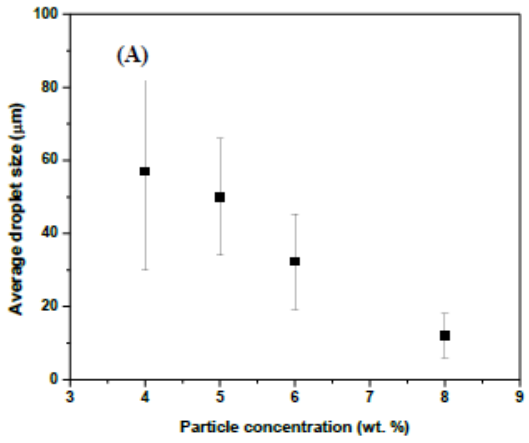
The phase separation induced by heating or cooling of a binary fluid mixtures having an upper or a lower critical solution temperature respectively, can be arrested by incorporating colloidal particles before initiating phase separation. The ability of colloidal particles to arrest phase separation in such systems has been recently exploited to create emulsions of complex morphologies – namely Bijels [1-3]. In current work, we exploit the colloidal interactions of interfacially trapped shape anisotropy particles to arrest phase separation in a phase separating binary liquid mixture. We show that colloidal rod-stabilized Pickering emulsions can be by obtained by arresting phase separation in lutidine-water (L-W) binary liquid mixture. In a typical experiment, a single phase homogenerous L-W mixture (at critical composition) containing silica rods was prepared. This solution was heated to a temperature above LCST (43°C) at a controlled heating rate of 28°C/min to induce phase separation. During the phase separation process, the particles migrate to the additional interface area created and hence stabilize the interface. As a consequence spherical droplets of emulsion were formed. Emulsion droplet size can be tuned by varying the particle concentration. The decrease in droplet size with increasing particle concentration follows the predictions of the limited coalescence phenomena.

A)



B)

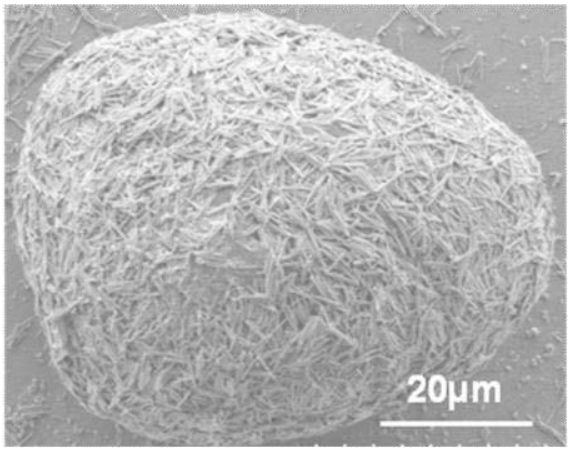


Fig. 1 (A) Effect of particle concentration on average droplet size - Average emulsion droplet size and droplet size polydispersity decreases with increasing particle concentration. Fig. 1 (B) Scanning electron micrograph of dried non-spherical water droplets stabilized by colloidal rods - obtained when a dispersion containing 4 weight % of rod shaped silica particle (AR ~ 5) in L/W mixture was heated from the temperature of 30° C to 43 °C at a maximum heated rate of 13 °C/min.

[1] Clegg, P.S., E.M. Herzig, , K.A. White, , A.B. Schofield, and W.C.K. Poon (2007)Bicontinous Emulsion Stabilized Solely by Colloidal Particles, Nat. Mater., 6, 966-968

[2] Cates M. E., and P. S. Clegg(2008) Bijels: a new class of soft materials,Soft Matter, 4, 2132–2138

[3] K. Stratford, R. Adhikari, I. Pagonabarraga,J.-C. Desplat, andM. E. Cates (2005)Colloidal Jamming at Interfaces: ARoute to Fluid-Bicontinuous Gels, Science, 309, 2198-2201