Yielding and Fracturing of Concentrated Emulsions in Narrow Gaps

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We characterised emulsion flow as droplets were confined by increasing the drop volume fraction and reducing the distance between the shearing surfaces. Attractive interactions between the drops caused them to flocculate. The contribution of the emulsion microstructure to its shear response becomes significant when the flocs almost span the distance between the surfaces. We found that confining the flow of droplet flocs causes a transition from a fluid phase with shear thinning flow behaviour into a jammed, solid-like material. Large deformations caused by flow at the maximum drop packing fraction induce droplet coalescence within highly localised regions of the emulsion.

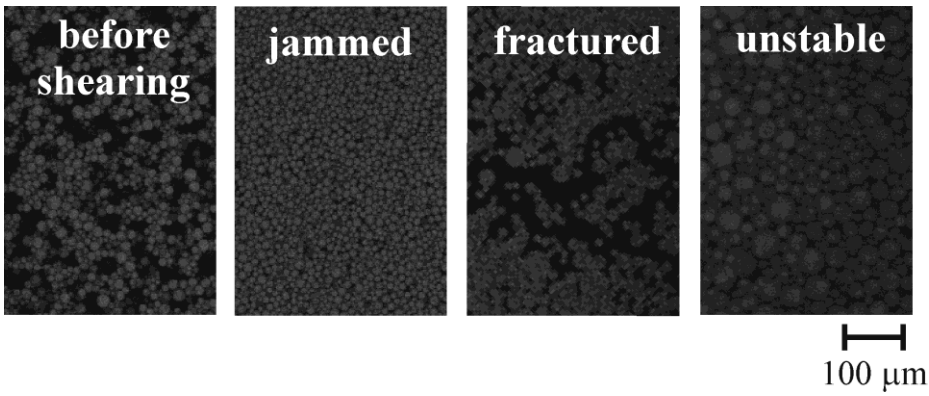

Fig. 1 Confocal fluorescence images of the oil drop microstructure in an emulsion sheared in confined space. Confining the emulsion flow causes the drops to jam together into a glassy, close-packed structure. Regions where clusters of drops and water flow form in between the jammed zones of drops (fracture flow). In some areas, the drops are unstable and coalesce together.