Nano-mechanical properties of Pickering emulsions

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Pickering emulsions are emulsions stabilized solely by solid particles which adsorb at the oil-water interface. It has widespread applications in industries: from food and pharmaceutical to petroleum and mineral. Over the last decade, the stabilization mechanisms of these emulsions have been investigated intensively using various techniques [e.g. 1,2,3]. Atomic force microscopy (AFM) has been widely used to study the interactions between two hard surfaces, and more recently, it has been extended to determine the interfacial forces between two soft surfaces [e.g. 4,5,6]. Here we have used this special technique (AFM) to further extend our understanding of Pickering emulsions. By compressing a clay-stabilized emulsion droplet with a colloidal probe, we were able to probe the mechanical properties of a drop in order to develop structure-function correlations with solution conditions. In addition, we were able to visualise the deformation of an emulsion droplets under different applied force using a combination of AFM and confocal microscope. The clay-stabilized droplets were found to be surprisingly strong and were independent of solution conditions at low compression. In contrast, the stiffness of the droplets increases with decreasing solution ionic strength at high compression. Preliminary result suggests that solution pH has no effect on the droplet mechanical properties.

References