Determination of Pore Space of a Highly Monodisperse O/W Emulsion Using NMR Diffusometry

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Emulsions are widely used in many commercial products including in the food, pharmaceutical, and cosmetic industries. Many applications make use of very high volume fraction emulsions where the pore/droplet structure and connectivity are important for the mechanical and end-user properties of the emulsion. For dilute emulsions, light scattering and optical and electron microscopy are suitable tools; however, they are generally unsuitable for highly concentrated emulsions or are destructive techniques [1]. Here, we illustrate the ability of an NMR pulsed field gradient stimulated echo (PFG-SE NMR) method to provide a measure of the droplet size and polydispersity as well as characterising the interstitial cavities of high volume fraction emulsions.

A highly monodisperse oil-in-water emulsion was been produced from polydimethylsiloxane (PDMS), Pluronic F127, and Milli-Q water by a microfluidic method. After creaming, the highly concentrated emulsion (~70% v/v) of the PDMS and the water in the pore spaces around the PDMS droplets were studied using a PFG-SE NMR diffusion technique. $Q$-space data shows distinct minima which are directly related to the pore size distribution in the emulsion [2, 3].

![Figure 1: Attenuation plots of PDMS and water signals of a highly monodisperse PDMS in water emulsion. Inset: optical microscopy image of the emulsion](image)