

P.37 Dynamics and structure: a study of gelation in a non-aqueous colloidal system

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Overbased detergents are a class of engine oil additive, comprising a metal carbonate core (typically 1-10 nm in diameter) surrounded by a sheath of surfactant molecules which are adsorbed to the particle surface. They are included in the lubricant to prevent deposit formation on the metal engine parts and to neutralise acids. With the increased use of bio-diesel, an increase in the volume of small polar molecules (such as water and acetic acid) contaminating the lubricant has been observed. The mechanism of water interaction with overbased detergents has not been fully understood, however, it is known that water hinders their efficacy.

The effect of water on the overbased detergent is largely determined by the interactions between the water and the surfactant molecules. When water was added to samples of salicylate overbased detergents, sedimentation of surfactant and some metal carbonate occurred in the following 24 hours. Upon the addition of water to solutions of a particular overbased detergent in *n*-dodecane, gelling occurs over a period of weeks. The dynamics of gelling and mechanical properties of the gel have been found to vary depending on the volume fraction of particles and the volume of water added. This system has been studied by dynamic light scattering (see fig. 1), small angle neutron scattering. The gels have been characterised using controlled stress rheology and thermogravimetric analysis; results have shown different compositions and rheological properties at different sample heights. The arrest is hypothesised to be due to a depletion interaction, induced by the formation of aggregates of surfactant [1]. Varying the particle volume fraction, volume of contaminant and free surfactant concentration have all been found to have an impact on the arrest.

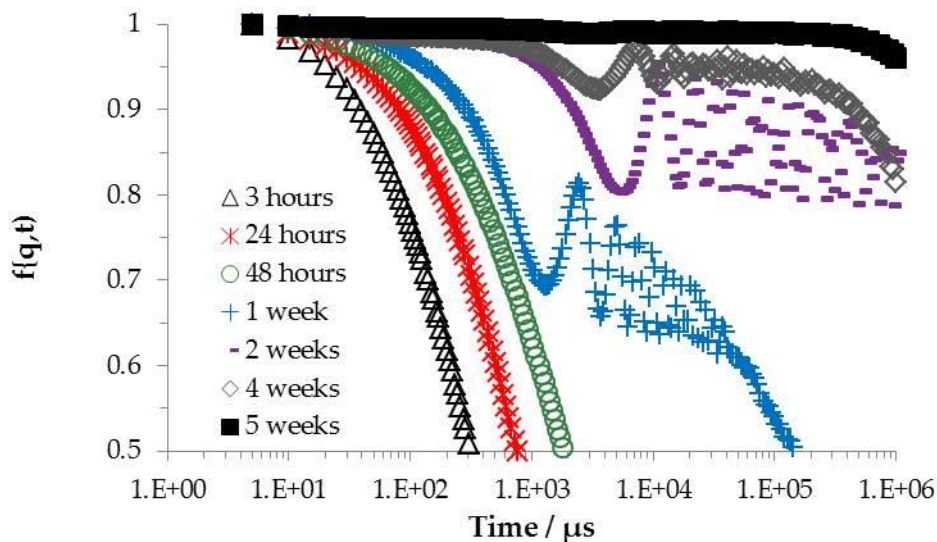


Fig. 1. Normalised intensity correlation functions, $f(q,t)$ of one gelling sample over 5 weeks.

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- [1] C. Lee, P Dowding, A. Doyle, K. Bakker, S. Lam, S. Rogers, A. Routh, Langmuir, 2013, 29, 14763-14771