McGill Chemical Society

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Bridging the Molecular to Macroscopic Divide Using Fluorescence: Application to the Study of Associative Polymers

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Otto Maass room 10

Water-soluble associative thickeners (ATs) are water-soluble polymers onto which hydrophobes have been covalently attached. In aqueous solution, associations between the hydrophobes result in the formation of polymeric aggregates which hinder the flow of the solution and increase the solution viscosity. Since the polymeric aggregates are not locked in place by permanent covalent bonds, applying shear to an AT solution disrupts the hydrophobic associations and leads to a drop in viscosity, a phenomenon referred to as shear thinning. The peculiar viscoelastic properties of aqueous solutions of ATs are due, for a large part, to the interactions taking place at the molecular level between the hydrophobes. This fact has led to a division of the research conducted on ATs between studies being done at the macroscopic level using rheology and at the molecular level using techniques such as fluorescence. At one end of the divide, rheologists conduct experiments aimed at characterizing the viscoelastic properties of an AT solution from which educated guesses are drawn to evaluate the behaviour of the hydrophobes at the molecular level. At the other end of the divide, the results obtained from experiments aimed at understanding the behaviour of an AT's hydrophobes at the molecular level are almost never corroborated by rheology experiments. This talk will present one of the very few examples where an AT solution is studied both at the molecular and macroscopic levels using a combination of fluorescence and rheology experiments. The AT is a hydrophobically modified alkali swellable emulsion copolymer (HASE) where the hydrophobes have been replaced by the hydrophobic chromophore pyrene. Fluorescence provides information about the pyrene-pyrene associations at the molecular level which can be correlated with the viscoelastic behaviour of the AT solution monitored by rheology.

Everyone is welcome