Fundamental Study of Yielding and Time-Dependent Flow Behaviour of Structured Fluids

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Brief description: Structured fluids are present in various forms such as suspensions, pastes, emulsions or gels. Examples may be found in a diverse range of industries and include mineral slurries, oils, paints, food, pharmaceuticals, cosmetics, etc. In these materials, particle interactions lead to formation of microstructures at rest. During processing or applications, depending on the state of the particulate structure and how it responds to external forces, a complex variety of macroscopic flow behaviour can be observed. A correct fundamental understanding of the actual rheological and flow behaviour of the material is essential for design of processes and equipment or optimisation of product formulation and performance. The project is focused on two important rheological characteristics exhibited by most structured fluids: yielding and thixotropic flow behaviour. The emphasis of the research will be on establishing that yield stress and thixotropy are not separate phenomena but are intimately related, both being manifestation of the particulate microstructure under shear. A fundamental knowledge of the complex interplay between yielding and time-dependent flow is central to the understanding of many issues related to flow property characterisation, constitutive model developments, process design and product developments involving structured fluids. The aim of this research is to provide a comprehensive fundamental understanding of the mechanisms involved in the rheology and flow of structured fluids through experimentation and modelling. The anticipated outcomes include improved methodologies for correct flow property measurements and a new model for complete description of the flow behaviour. The advanced knowledge gained will facilitate developments of new technologies and products and solutions of material handling and flow problems in a diverse range of processing industries.

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