LABORATORY OF BIOPHYSICS

WAGENINGEN UNIVERSITY & RESEARCH

BRUKER

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Microflow-MRI study of dispersions and anisotropic particles

Flow of soft particle dispersions, such as emulsions or gels in sub-mm confinement is present in *e.g.* 3D micro-printing or food and cosmetics production (Fig. 1a). Flow in millimetre-sized capillaries is also encountered in the extrusion of polymer fibers and liquid crystalline materials with shear-dependent anisotropic orientation. In these processes, the properties of the final products, *e.g.* stability or durability, are dictated by the behavior under flow. Therefore, understanding the flow properties is very important for rational product design and using the optimal production conditions: pressures, temperatures and confinement sizes. This task is however very difficult to achieve as flow in such small gaps strongly depends on complex interparticle interactions, which are yet not very well understood.

The group at BIP has designed a flexible microcapillary setup for flow-MRI measurements which (i) enables studying flow in a range of sub-mm confinements with different wall properties and (ii) can be used for high-resolution chemically- and spatially-resolved flow-MRI measurements in high-field NMR spectrometers (Fig. 1b).

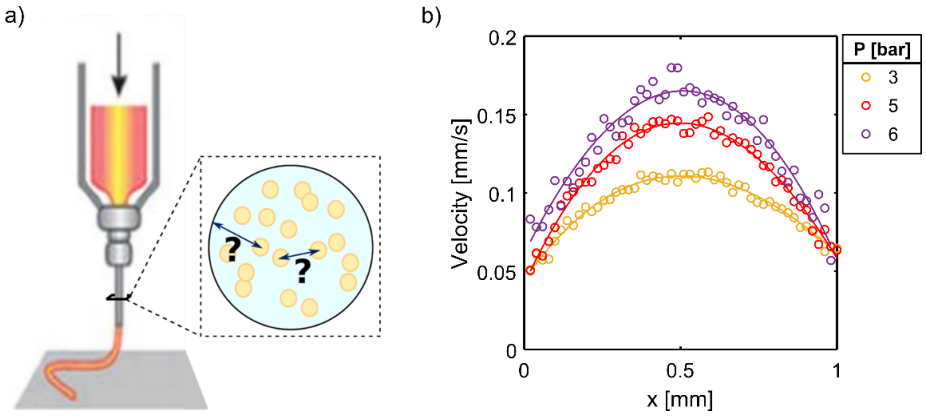

Figure 1: a) schematic representation of a strongly confined flow of particle dispersions in a sub-mm capillary, b) ^{1}H flow-MRI velocity profiles of a silicone oil in a 1 mm capillary.

This project involves applying the new microflow-MRI setup to measurements of flow behavior of model systems, such as simple emulsions or wormlike micelles under flow. The measurements are then compared with the flow behavior as predicted by the classical rheology, and fitted with models describing strongly confined flow. Results are then interpreted in terms of inter-particle interactions and microstructural dynamics of the system. Measurements are carried out on the in-house NMR spectrometers and data analysis is done using in-house developed scripts (MATLAB).

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