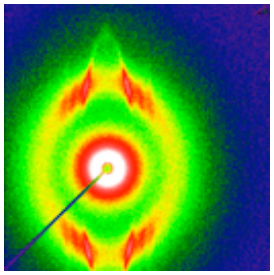

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Keynote 1 - X-ray imaging of flowing concentrated suspensions

Monday, 10 December 2018 13:30 (40)

A key element to understand the rheological behavior of suspensions is their microstructure: the spatial distribution of particles depends on flow history, which has an impact on the suspension macroscopic properties. This appeals for the development of experimental tools allowing for the 3D imaging of particles in viscosimetric flows.
At a macroscopic scale, concentrated suspensions often display concentration inhomogeneities, due to shear-induced migration. These inhomogeneities can lead to the formation of jammed regions, which have a strong impact on the measured behavior. It is crucial to describe this phenomenon near the jamming transition and in shear-thickening fluids. It is thus necessary to develop new tools to get time- and spatially-resolved concentration fields in flowing suspensions.
In this talk, we present recent developments to tackle these issues with the help of X-ray Imaging.
We first present a technique to image the microstructure of suspensions of non-Brownian particles in 3D, using X-ray computed tomography and sub-voxel identification of particle centers. We illustrate its interest on a few examples. We show that one can get an isotropic microstructure after mixing. Under shear, the microstructure becomes anisotropic in the shear plane, whereas it is isotropic in the 2 other planes. While for Newtonian suspensions the anisotropy is independent on the shear rate, we show that for a yield-stress suspension it depends on it; this implies a shear-dependent behavior of the suspension. Finally, we evidence particle alignment along both solid surfaces and free interfaces.
We then present a technique to get time-resolved 2D concentration fields in a rheometric flow, thanks to 2D X-ray radiography. We illustrate its interest for shear-thickening fluids. We show that most suspensions display strong concentration inhomogeneities at the onset of Discontinuous Shear thickening (DST), which poses the question of the intrinsic (local) behavior of DST suspensions and might lead to revisit the interpretation of this behavior.

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