Flow of dense granular suspensions: an experimental study.

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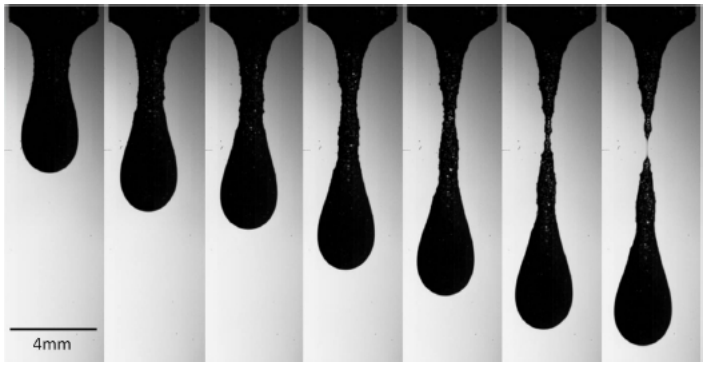

Figure 1: Detachment of a drop of a granular suspension ($\phi = 40\%$, grain diameter 140 μm.)

We study experimentally the flow of dense granular suspensions. The suspensions are made of monodisperse, spherical, non-Brownian polystyrene beads immersed in density matched silicon oil. The volume fraction ϕ can be varied from 30 to 61%. We investigate the flow behaviour of these dense granular suspensions by the use of two complementary geometries: shear flow on an inclined plane and elongation flow during the detachment of a suspension droplet. We show that the inclined plane is a useful rheometer suited to explore the continuous transition from an effective viscous flow (high thicknesses) to dense "pseudo-granular" flow (low thicknesses). A mesoscopic length scale separates the two flow regimes and diverges when the volume fraction approaches the jamming limit [2]. This set-up allows for measuring the viscosity directly up to volume fractions as large as 61%, which is impossible with a classical rheometer [1]. In the case of the "pinch-off" experiments, we show that the elongation viscosity is identical to the one measured on an equivalent pure viscous liquid. Nevertheless, the final detachment regime is accelerated by the presence of grains. Moreover, we find a dynamical process independent of the grain concentration, but slightly dependent on the grain size [3].

References

[1] C. Bonnoit, T. Darnige, E. Clement, and A. Lindner, J. Rheol. **54**, 65 (2010)

[2] C. Bonnoit, J. Lanuza, A. Lindner, and E. Clement, Phys. Rev. Lett. **105**, 108302 (2010).

[3] C. Bonnoit, T. Bertrand, E. Clement, A. Lindner, sub-mitted, arXiv :1009.1819v2

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