Séminaire

Vendredi 20 octobre 2023 à 10h30

Amphithéâtre Henri Benoît et visio

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Jamming and Unjamming of Soft Colloids

In this work we study the jamming and the fluidisation of soft colloids by Large amplitude oscillatory shear (LAOS) experiments. Unlike hard particles, soft colloids can overlap and deform and thus can be compressed up to packing fractions that cannot be explored in hard sphere systems. By means of dynamic light scattering experiments[1],we first explore the microscopic dynamics of model ultrasoft colloids, namely ultra-low crosslinked microgels, as a function of their volume fraction, going from a supercooled liquid to a jammed glassy regime. We show how, even for very soft colloids, the relaxation times increases of several order of magnitudes in a narrow range of volume fractions, akin to hard sphere suspensions, and that the glass transition is marked by the passage to nearly-equilibrated states showing relaxation times very weakly dependent on volume fraction.

The macroscopic flow behaviour of these (and other) jammed suspensions are then studied by applying a periodic shear field. By inspecting the intra-cycle stress response of different soft glasses to an imposed oscillatory deformation and decomposing it into an elastic and a viscous contribution[2], we will first show that yielding very generally consists in a continuous transition from a transient shear thickening to a shear thinning behaviour, the latter appearing when the two stress components are both nearly constant within the same finite window of strain and strain rate. We revise the standard definition of yielding, namely the crossover between the first harmonic storage and loss modulus, in the light of this new finding.

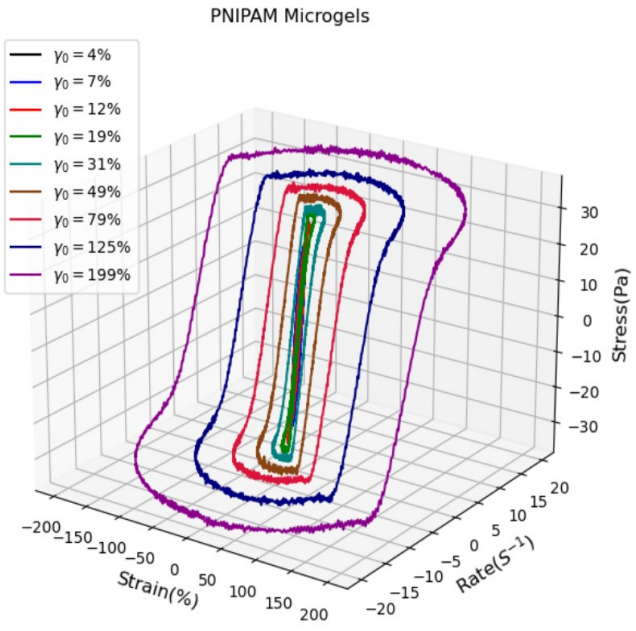

Figure 1: Full 3D stress response of a model colloidal glass, as a function of strain and strain rate for different strain amplitude

[1] Adrian-Marie Philippe, et al, Physical Review E, 2018
[2] Randy. H. Ewoldt, et al, Journal of Rheology, 2008

This work is in collaboration with Alexander Petrunin, Edouard Chauveau, Andrea Scotti, Luca Cipelletti, and Domenico Truzzolillo

Les personnes souhaitant rencontrer R. Elancheliyan sont priées de prendre contact avec Aurélie Hourlier-Fargette.