

CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE

Mercredi 21 mars 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

How do yield stress materials start to flow?

Sébastien Manneville

Laboratoire de physique, ENS-Lyon

Yield stress materials are viscoelastic solids at rest but behave as viscous liquids when stressed above their yield stress. In soft jammed systems, yielding can be seen as an instance of an unjamming transition driven by the shear stress. The question of whether this shear-induced fluidization displays universal features, in a way similar to jamming driven by temperature or by volume fraction, has triggered much research effort in the recent years. Experimentally, difficulties arise from the need to measure deformations and flows close to yielding at vanishingly small shear rates with sufficient spatial and temporal resolutions.

In this talk, I will first review the current state of research on the steady state reached by a soft glassy system above yielding. It is now established that some "simple" materials undergo a continuous yielding transition characterized by homogeneous flows while others display flow heterogeneities, e.g. shear bands, at steady state. I will then concentrate on the spatiotemporal fluidization dynamics of a "simple" yield stress material, namely a carbopol microgel, that presents negligible aging and thixotropy. Through long experiments combining standard rheology and ultrasonic velocimetry under imposed strain or stress, I will show that the material first undergoes a transient regime characterized by (i) a short-time creep regime reminiscent of Andrade creep in elastic solids and (ii) a long-lasting shear banding regime that progressively gives way to homogeneous flow. The duration of the shear-banding regime decreases as power laws of the applied shear rate and of the applied viscous stress. These power laws nicely combine to recover the Herschel-Bulkley law characteristic of the steady-state rheology of our microgel. Time permitting, I will briefly address the case of other yield stress materials, showing that the above fluidization scenario is probably not universal.

A coffee break will be served at 11h00. The seminar will be given in English.

Contact : patrice.bertet@cea.fr/sebastien.aumaitre@cea.fr –Tel : +33 1 69 08 55 29 / 74 37
<http://iramis.cea.fr/spec/>