An experimental study of creep in non-cohesive granular materials

Cécilia Gicquel*†[1], Ambroise Mathey[1], Jérôme Crassous[1], and Axelle Amon[1]

[1]Institut de Physique de Rennes – CNRS-Université de Rennes1 – France

Abstract

This work aims to contribute to the understanding of the origin of creep deformation in non-cohesive granular materials, that is, their response to a constant stress loading. We have performed biaxial tests on samples made of glass beads which diameter is comprised between 70 and 100 microns, used as an athermal amorphous model material. The use of such samples enables us to observe local deformation and rearrangement over time thanks to an interferometric method. Previous studies have demonstrated that when those samples are submitted to constant strain rate loading, the deformation localises in shear bands at a critical value of the stress. We have carried out stress-imposed experiments and report the observation of creep deformation in the sample. Three stages are observed: first the strain rate decreases as a power-law with an exponent close to one, then a stationary regime of variable duration is observed during which the strain rate stays approximately constant, finally an acceleration of the strain rate until the failure of the sample is observed. Our method of measurement allows us to observe and study the spatial distribution of the deformation during the different phases of the creep process. To the best of our knowledge it is the first time that the three stages of creep are observed in granular materials, especially the acceleration towards failure.

*Speaker

†Corresponding author: cecilia.gicquel@univ-rennes.fr