Contribution ID: **1334** Type: **Oral (Non-Student) / orale (non-étudiant)**

XPCS studies of shear-induced rejuvenation and nano-plasticity in soft glassy materials

Tuesday 14 June 2016 09:00 (15 minutes)

We present x-ray photon correlation spectroscopy experiments on a set of soft glassy solids, including concentrated nanocolloidal gels, nanoemulsions, and Laponite clay suspensions, subject to in-situ oscillatory shear strain that provide insight into particle rearrangements above yielding at the nanometer scale and their connection to dynamical and mechanical behaviour of the materials. The oscillatory strain causes periodic echoes in the x-ray speckle pattern, creating peaks in the intensity autocorrelation function. The peak amplitudes are attenuated above a threshold strain, signalling the onset of irreversible particle rearrangements. These materials generally exhibit macroscopic strain softening (as measured by mechanical rheometry) well below the XPCS peak attenuation threshold, indicating a range of strains at which deformations are nonlinear but reversible. In the gels, the peak amplitudes decay exponentially with the number of shear cycles above the threshold strain, demonstrating that all regions in the sample are equally susceptible to yielding and surprisingly that the probability of a region yielding is independent of previous shear history. However, in the Laponite clay suspensions, which exhibit characteristic mechanical aging behaviour during gelation, attenuation of echoes in he x-ray speckle pattern can be long lived for modest strain amplitudes, a hallmark of mechanical rejuvenation phenomena.

Author: HARDEN, James L. (University of Ottawa)

Co-authors: CHEN, Kui (Johns Hopkins University); ROGERS, Michael C (University of Ottawa); LEHENY, Robert L. (Johns Hopkins University); ABIDIB, Samy (University of Ottawa); RAMAKRISHNAN, Subramanian (FAMU-FSU College of Engineering); NARAYANAN, Suresh (Argonne National Laboratory); MASON, Thomas G. (UCLA)

Presenter: HARDEN, James L. (University of Ottawa)

Session Classification: T1-6 Nanostructured and Functional Nanomaterials (DCMMP-DIAP) / Nanomatériaux nanostructurés et fonctionnels (DPMCM-DPIA)

Track Classification: Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)