MULTI-SCALE MICROSCOPY APPLIED FOR MATERIAL CHARACTERIZATION

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Focus Material: Metals

Focus of the Presentation: *Multi-scale data acquisition, characterization and experiments at different scales;*

Abstract

A new device has been developed at Onera in order to improve *in situ* mechanical tests (tension, compression, bending) and by observing at the same time local and global displacement fields. This is possible combining both observations from optical and beam electron microscopes. The optical microscope is used to observe and measure the far displacement field while the SEM focuses on specific areas allowing a higher resolution. The local and global displacement and deformation fields are measured and computed through a real-time Digital Image Correlation (DIC) acquisition system. The information acquired with this experimental device combined with non-linear finite element analyses is a new approach to propose and to identify constitutive equations for *in situ* materials which can not be handling at the macroscopic scale. It is then possible to observe the influence and the evolution of dissipative phenomena like plasticity or damage at the microscopic scale (e.g. grains for metallic materials, fibers for composite materials).
This approach has been successfully achieved for several applications like the mechanical characterization of architectured microstructures or the modeling of shot peened structures.