MECHANICAL PROPERTIES AND PLASTICITY OF SMALL-SCALE MATERIALS

MATTEO GHIDELLI[*], OGUZ UMUT SALMAN[*] AND HOSNI IDRISSI[†]

[*] Laboratoire des Sciences des Procédés et des Matériaux (LSPM) - French National Centre for Scientific Research (CNRS), 99 avenue J.-B. Clément, 93430, Villetaneuse, France
matteo.ghidelli@lspm.cnrs.fr; umut.salman@lspm.cnrs.fr; www.lspm.cnrs.fr

[†] Institute of Mechanics, Materials and Civil Engineering (iMMC), IMAP, Université catholique de Louvain, B-1348 Louvain-la-Neuve, Belgium
hosni.idrissi@uclouvain.be ; https://uclouvain.be/en/research-institutes/immc

The study of mechanical properties of small scale materials (i.e. thin films, nanostructures, etc.), along with the localized mechanical behavior of bulk materials, is a major focus of ongoing research. This is driven by a wide range of applications and the pressing need to develop novel high performance materials that exhibit mutually exclusive mechanical properties, such as yield strength and plasticity or capable to resistance to complex mechanical solicitations, wear, fatigue, and extreme temperatures.

Recent advancements have significantly expanded testing methodologies, allowing for the detailed examination of elastic, plastic, fracture, and fatigue properties at small scales. These techniques enable precise control over loading modes, temperature, and environmental conditions, often incorporating real-time imaging and leveraging multiple data signals during deformation.

Within this contexts, this symposium bring together the experimental mechanics research community, with a focus on nano- and micro-mechanical testing and modelling. Specifically, this includes:

- Mechanical behavior of small scale materials (thin films, nanostructures etc.) and local properties of bulk materials, focusing on *in situ* and *in operando* techniques such as nanoindentation, SEM, TEM, AFM, synchrotron, X-Ray mechanical testing etc.
- Multiscale deformation and failure mechanisms (from atomic to micro-scale), bridging observations of deformation and failure across multiple length scales together with simulations.
- Nano- and micromechanics in extreme conditions (i.e. high/low temperatures), non-conventional loading conditions (i.e. high strain rate, nano-tribology).
- Different materials (crystalline metals, amorphous materials, architected materials, beam structures, materials with different phases, granular materials, thin films).
- Integrated modelling and characterization including modeling for mechanistic discovery, experimental interpretation, parameter calibration, or model validation.
- Modeling tools that address the fluctuation-dominated mechanics providing insight into the behavior of materials at micro- to nano-scales.