# EFFECT OF STRESS PATH ON THE MINIATURIZATION SIZE EFFECT FOR NICKEL POLYCRYSTALS

**C. Keller\*, E. Hug\*\*, L. Duchêne+, A.M. Habraken+**

**\*Groupe de Physique des Matériaux, Université de Rouen, Insa de Rouen, CNRS UMR6634, av. de l'Université, 76800 Saint-Etienne du Rouvray, France, clement.keller@insa-rouen.fr**

**\*\*Laboratoire CRISMAT, Université de Caen, Ensicaen, CNRS UMR6508, bv. du Maréchal Juin, 14050 Caen, France, eric.hug@ensicaen.fr**

**+Département Argenco, secteur MS²F, Université de Liège, Sart-Tilman, B52, 4000 Liège, Belgique, l.duchene@ulg.ac.be, anne.habraken@ulg.ac.be**

**ABSTRACT‑** The mechanical behavior of metallic materials deeply depends on the size of samples. For specimen dimensions decreasing from a few millimeters to a few micrometers, the general observed trend is a softening of the mechanical behavior in tension which affects the stress level and the strain hardening. This effect is triggered by the decrease of the number of grains across the thickness (also called thickness “t” over grain size “d” ratio). The objective of this work is to provide new experimental results in order to analyze the miniaturization size effects for various stress paths without strain gradients across the thickness of the samples. To this aim, experimental tensile tests, large tensile tests and shear tests have been performed on Ni sheets (0.5 mm) with various grain sizes ensuring different t/d ratios. Results show that the miniaturization softening is affected by triaxiality, the larger is this parameter, the lower is the mechanical softening. These features seem to be linked to surface effects which are larger for low triaxiality stress paths. Attempts of numerical simulations using strain gradient crystal plasticity model are also performed to confirm the role played by surface effects.