MM 13: HV Motz

Time: Tuesday 10:15–10:45 Location: IFW A

Invited Talk MM 13.1 Tue 10:15 IFW A

Plasticity in confined volumes: new insights into small-scale plasticity — •Christian Motz — Erich Schmid Institute of Material Science, Austrian Academy of Sciences, A-8700 Leoben, Austria

The ongoing miniaturization in many areas of modern technologies, e.g. medical devices, microelectronics, etc., requires material properties in small dimensions. Size effects in mechanical properties prevent the usage of macroscopic material properties. In the last years, it was generally found that there is a specimen size effect on plasticity, i.e. smaller is stronger, if the typical size is reduced to the micrometer regime or below.

3-D discrete dislocation dynamics simulations were performed on samples with sizes from 0.5 to 2 μm to study the size effect and the underlying physical mechanisms. It is shown that the mechanical response strongly depends on the initial dislocation structure and density. For low densities and small samples high flow stresses are observed and the stress vs. strain response shows significant strain bursts. This behaviour is attributed to the inefficiency of generating dislocation sources required for sustained plasticity. For high dislocation densities and/or large samples the flow stress is significantly smaller and a smooth stress vs. strain response is observed. The observed deformation regimes are illustrated in a deformation mechanisms map. Finally, the simulations are compared to experimental data from small-scale experiments, whereas a good agreement is found.