

Mechanical Behaviour of Nano Grained Metals

Aman Haque, **Taher Saif**

U. of Illinois, Urbana-Champaign, USA

Mechanical behavior of free standing nano grained thin Al and gold films are studied experimentally under uniaxial tension using a newly developed novel microinstrument. Here, the sample and the instrument are patterned (lithographic technique) and fabricated together, thus eliminating the problem of alignment and attachment. We find, as grain size decreases, yield stress increases, elastic modulus decreases, and the metals begin to show non-linear elasticity upon unloading. There appears to be a critical grain size at which the material shows maximum strength. Below this size, the failure appears to be macroscopically brittle. We believe that as grain size decreases, dislocation slip induced plasticity ceases to exist due to lack of dislocations, and grain boundary mechanisms begin to dominate. However, if the grain size is such that it is small enough that few dislocation exists but not small enough for grain boundary assisted mechanisms to dominate, the material shows highest strength.

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