

Mechanical properties of nanocrystalline thin films

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Tensile tests of nanocrystalline 50 nanometers thin films prepared from Al3wt.%Mg alloy were performed in-situ in transmission electron microscope using Hysitron PI 95 system. Deformation by grain rotations, low density of dislocations inside grains and intergranular failure of specimens were confirmed by conventional TEM, HRTEM, and automated orientation phase mapping (ACOM-TEM). Conditions of experimental deformation were simulated by molecular dynamics (MD). Good coincidence in main features, namely deformation by grain boundary mechanisms and intergranular failure, was reached. However, discrepancies in mechanical properties such as tensile and yield strength resulting from both methods prevail. They are linked to a high symmetry of simulated grains and imperfections of the real sample grain boundaries.

Keywords: nanocrystalline thin films, in situ TEM, molecular dynamics

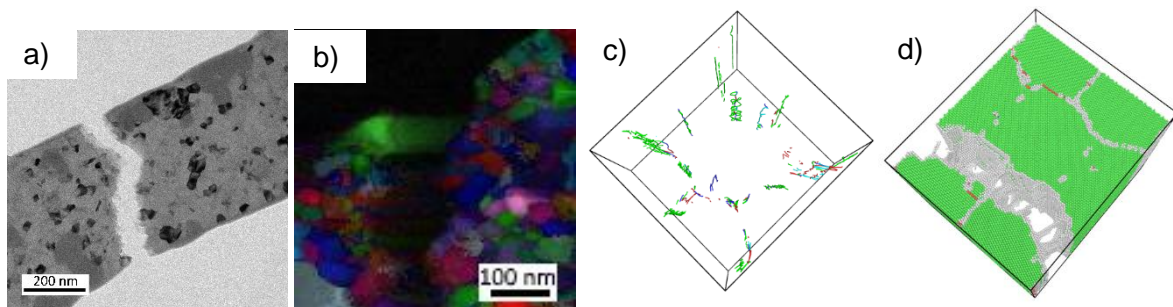


Fig.1 a) TEM image of tensile specimen b) ACOM-TEM orientation map, MD visualization of dislocations during straining, d) thin film failure simulated by MD.

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