

Thicker Grain Boundaries Reduce Localized Failure in Nanocrystalline Alloys

Scientific Achievement

Controlling and increasing grain boundary thickness is a key strategy to enhance stable plastic flow, resistance to strain localization, and overall durability of nanocrystalline metals under mechanical stress.

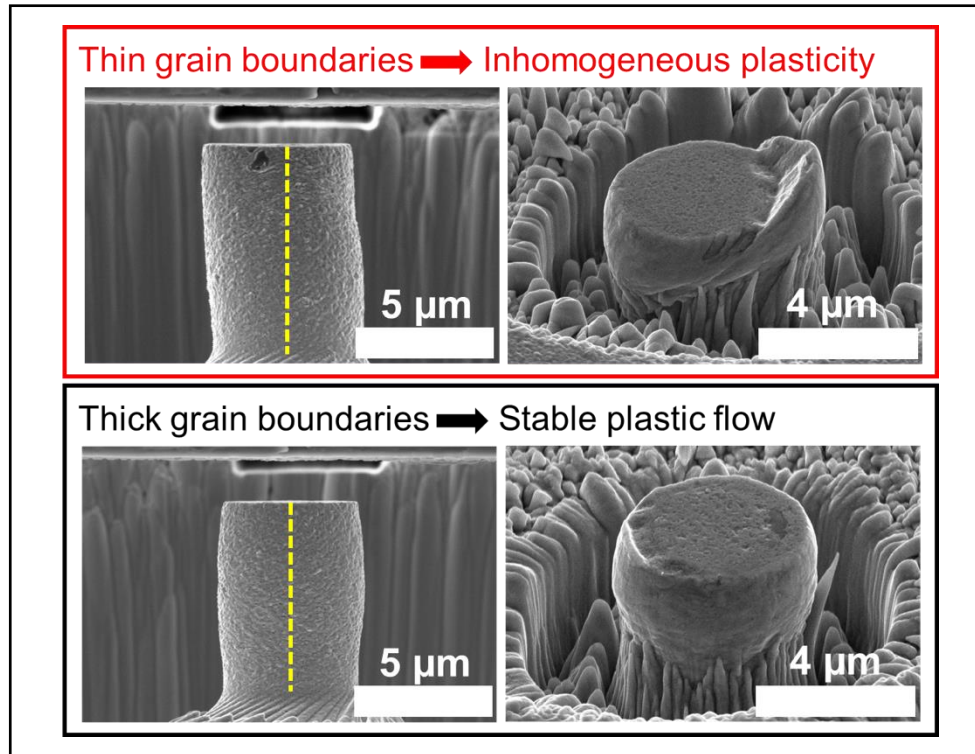


Figure: examples of deformed micropillars for the population with thinner grain boundaries (upper red box) and thicker grain boundaries (lower black box).

Significance and Impact

Grain boundary thickness, an important structural descriptor, affects plasticity and failure modes of nanocrystalline Cu-Zr, where thicker boundaries promote more uniform plastic deformation and greater resistance to damage.

Research Details

- Two model materials were created differing only in boundary thickness, with one having a thicker population than the other.
- Over 50 micropillars were compressed in-situ to quantify plasticity and failure modes.

Hessong, E. C.; Maria della Ventura, N.; Niu, T.; Gianola, D. S.; Kim, H.; Li, N.; Fensin, S.; Boyce, B. L.; Rupert, T. J. Thicker Amorphous Grain Boundary Complexions Reduce Plastic Strain Localization in Nanocrystalline Cu-Zr. *Scripta Materialia*. 2026.

Work was performed, in part, at the Center for Integrated Nanotechnologies.



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