

# LA-UR-13-23145

Approved for public release; distribution is unlimited.

Title: Institutional Computing Annual Report 2012 - Project:  
W12\_copperstrength

Author(s): Germann, Timothy C.

Intended for: Web

Issued: 2013-05-01



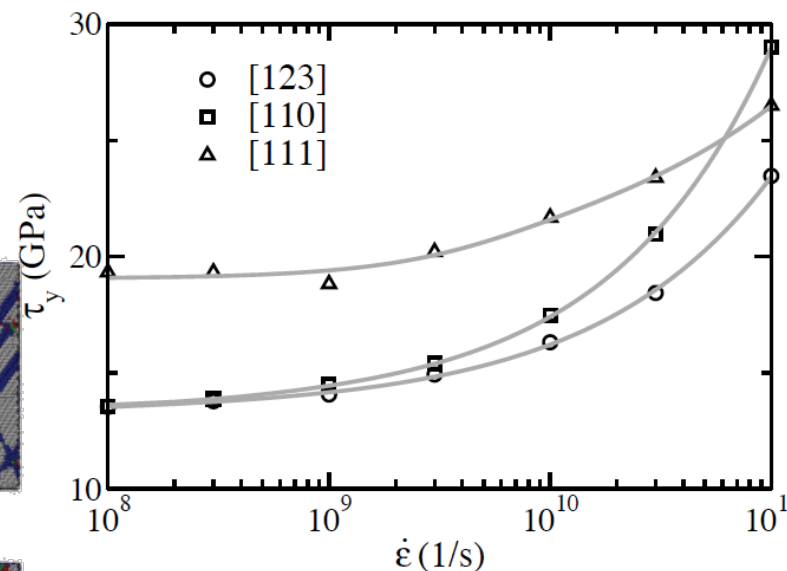
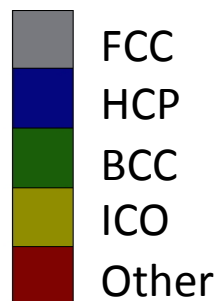
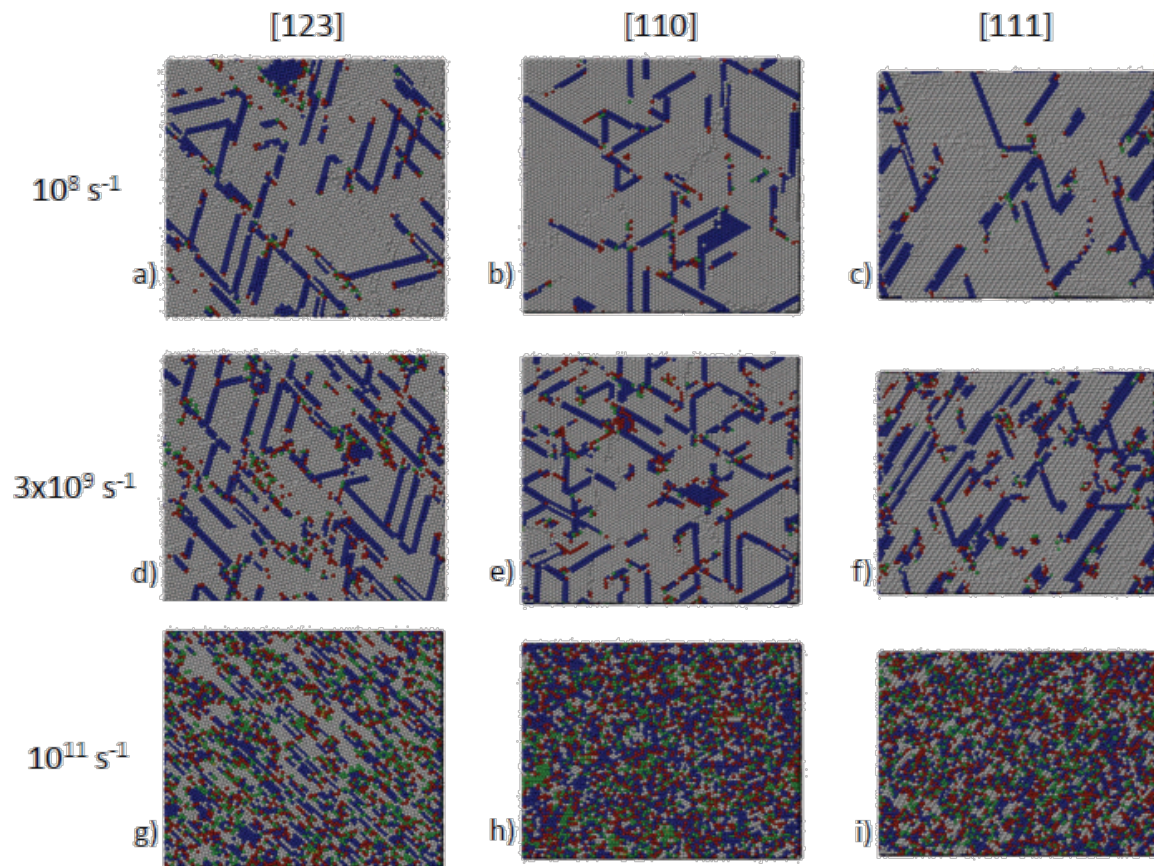
## Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

# Institutional Computing Annual Report 2012

Project: W12\_copperstrength

PI: Timothy C. Germann (T-1, [tcg@lanl.gov](mailto:tcg@lanl.gov), 5-9772)



## Main findings for **single crystals**:

- [111] is stronger at low strain rates and yields at higher strains; strain rate has the least effects on these samples (above)
- 3 deformation regimes observed: homogeneous nucleation of dislocations, amorphization, intermediate

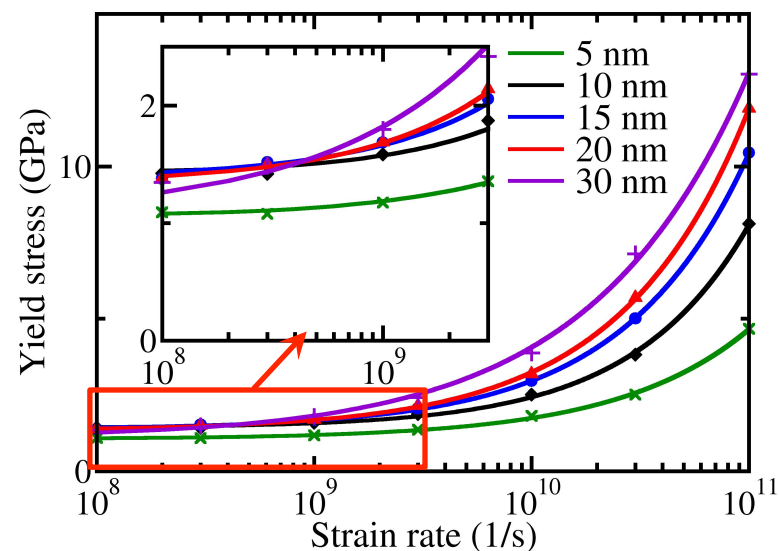
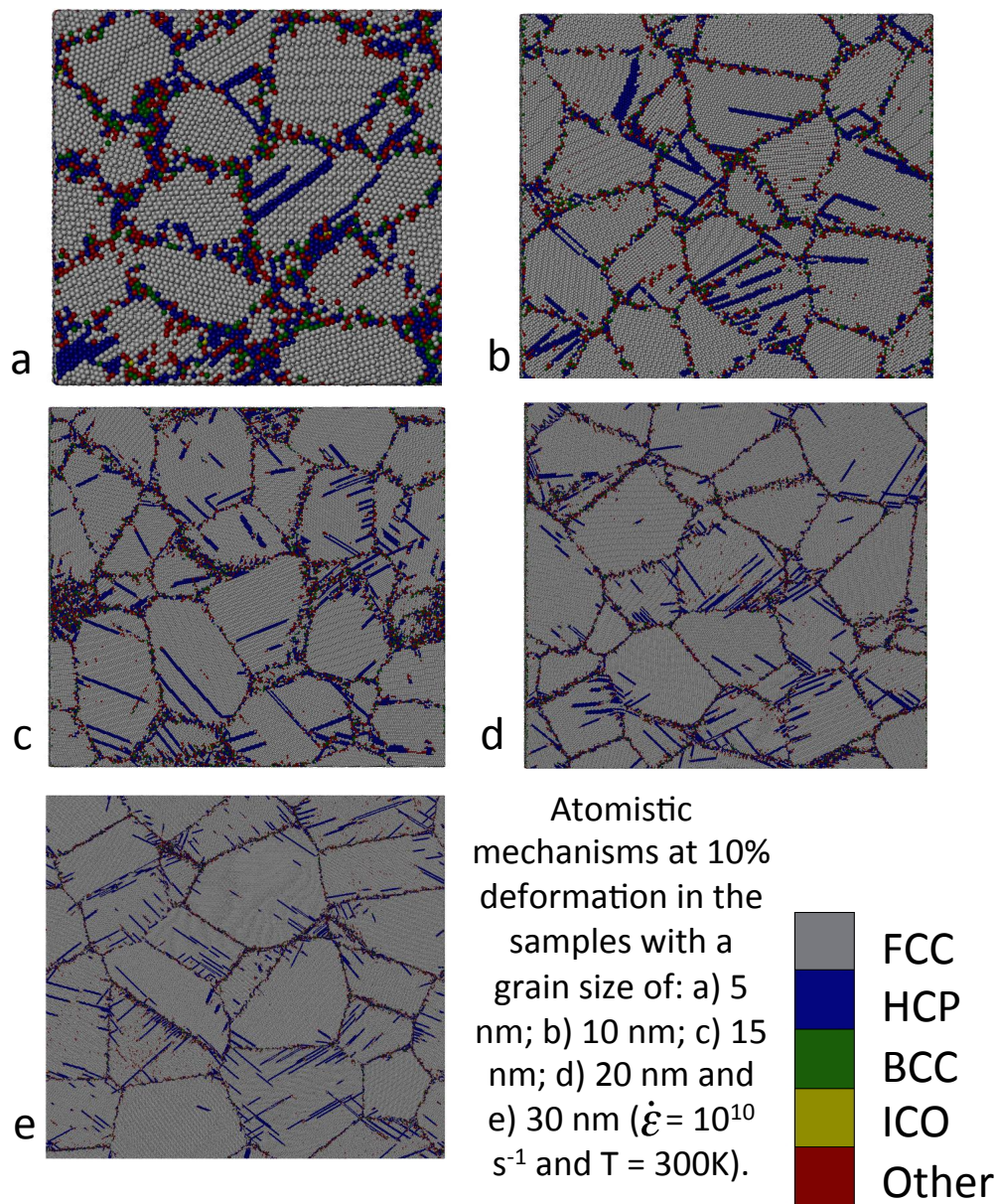
regime where disorder is relaxed by nucleation of dislocations (left)

- Criterion based on the critical resolved shear and normal stresses is not enough to predict yielding at all strain rates

# Institutional Computing Annual Report 2012

Project: W12\_copperstrength

PI: Timothy C. Germann(T-1, [tcg@lanl.gov](mailto:tcg@lanl.gov), 5-9772)



Evolution of the yield stress as a function of strain rate.

## Main findings for **polycrystals**:

- Preliminary results indicate that strongest grain size is strain rate dependent (above)
- Deformation mechanisms change from boundary sliding to dislocation nucleation with increasing grain size (left) and increasing strain rate

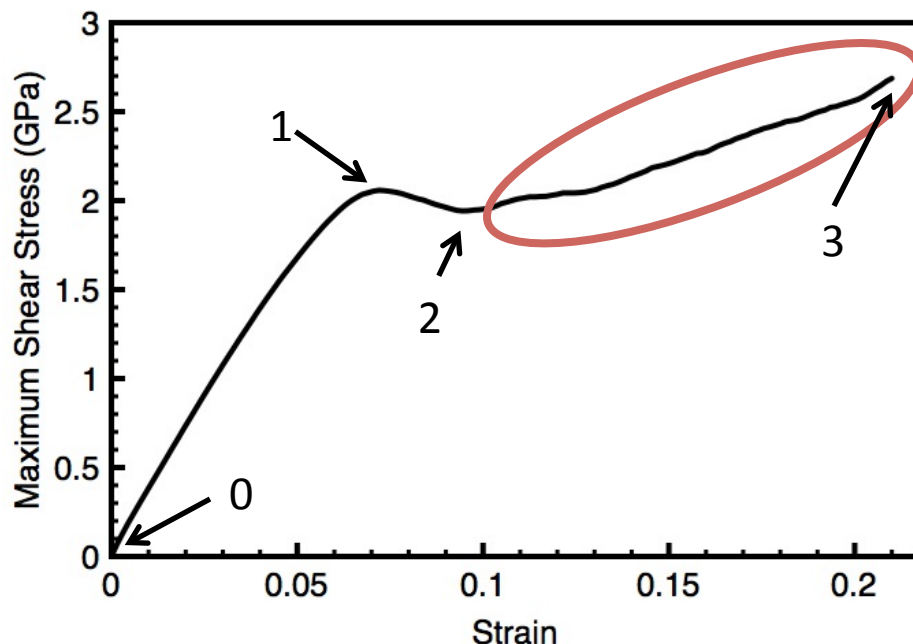
V. Dupont and T. C. Germann,  
*Phys Rev B* **86**, 134111 (2012)



# Institutional Computing Annual Report 2012

Project: W12\_copperstrength

PI: Timothy C. Germann (T-1, [tcg@lanl.gov](mailto:tcg@lanl.gov), 5-9772)



(Above) Stress-strain curve for 15-nm grain size polycrystal at 300 K and  $3 \times 10^9 \text{s}^{-1}$ .

## We are currently investigating:

- the strengthening effect observed in polycrystals (left); and
- methods for quantifying the competition between intergranular and intragranular slip (below)

(Below) Slip sustained by sample between (a) point 0 and 1 on graph; (b) 1 and 2 and (c) 2 and 3

