

Modeling dislocation nucleation and strength in nanowires and nanopillars

Andrew T Jennings¹, Christopher R Weinberger², and Julia R Greer¹

¹⁾ Sandia National Laboratories, ²⁾ California Institute of Technology

Experiments have shown that plasticity in confined volume single crystals can be controlled either through single arm sources or dislocation nucleation; the transitions of which are size and microstructure dependent. Here, we develop a simple continuum model that captures the activation energy and activation volume of dislocation nucleation from free surfaces. The nucleation strength dependence on crystal orientation, surface facets and material properties are investigated and compared against traditional single arm source operation. This provides a map for transitions from conventional source limited plasticity controlled by single arm sources to surface nucleation.

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