

Atomic resolution in-situ TEM observation on brittle-ductile transition of nano-wires with covalent bonding

X. D. Han and Z. Zhang*

Institute of Microstructure and Property of Solid Materials, Beijing University of Technology, Ping-le-yuan 100, Chaoyang Dis., 100124 Beijing, China

[*zezhang@bjut.edu.cn](mailto:zezhang@bjut.edu.cn)

Abstract

In this talk, we shall introduce a newly developed method of in-situ atomic resolution observation of nanowires under bending or tensile strain conducted in a transmission electron microscope. We provide a comprehensive review on the methodological development and technical applications of *in situ* microscopy, for investigating the structure-mechanical-property relationship of a single one-dimensional nanowire. Details are presented on the direct imaging of brittle to ductile transition and plastic to superplastic behavior of semiconductor nanowires at atomic resolution, providing quantitative information on the mechanical behavior of nanomaterials. The studies on the Si and SiC nanowires clearly demonstrated their distinct, “unexpected” and superior plastic mechanical properties. Finally, a perspective is given on the future of nanomechanics.