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# In-situ Nanomechanics of Crystalline Nanowires


## Yong Zhu

*Professor*
*Department of Mechanical and Aerospace Engineering, North Carolina State University, Raleigh, NC*



## ABSTRACT:

A wide variety of crystalline nanowires with outstanding mechanical properties have recently emerged. These nanowires are not only promising building blocks for many device applications, but also an ideal platform to study fundamental nanomechanics. In this talk, I will discuss the challenges and recent advances in the field of experimental nanomechanics, and present an innovative MEMS-based method for in-situ scanning and transmission electron microscopy mechanical testing of nanowires. Then I will discuss two recent studies that highlight the important roles of defects in mechanics of crystalline nanowires. For metal nanowires containing twin boundaries along the axial direction, we observed a time-dependent and fully reversible plastic behavior. We concluded that vacancies reduce dislocation nucleation barrier, facilitating stress relaxation, while the twin boundaries promote retraction of partial dislocations, resulting in full strain recovery. For single-crystalline nanowires containing point defects, we discovered a giant anelastic behaviour that was up to four orders of magnitude larger than the largest observed in bulk materials, which was attributed to point defect diffusion under a high strain gradient and short diffusion distance. This talk will conclude with the application of nanowires in the field of stretchable electronics.


## BIOGRAPHY:

Yong Zhu is a Professor in the Department of Mechanical and Aerospace Engineering (affiliated in Materials Science and Engineering and Biomedical Engineering) at North Carolina State University (NCSU). He received his B.S. degree from the University of Science and Technology of China, and his M.S. and Ph.D. degrees from Northwestern University. He was a postdoc at the University of Texas at Austin before he joined NCSU in 2007 as an Assistant Professor. His group conducts research at the intersection of solid mechanics and micro/nano-technology, including nanomechanics, microelectromechanical systems and nanomaterial-enabled stretchable/ wearable electronics. Dr. Zhu has received a number of awards and honors including Department Outstanding Research Award, College of Engineering Alcoa Foundation Research Achievement Award, University Faculty Scholar, Society of Experimental Mechanics Young Investigator Lecture Award, ASME Sia Nemat-Nasser Early Career Award, and Eshelby Mechanics Award.