Nanoparticles/Nanotubes - Mechanical Properties (F-D Spectroscopy)

Sample:
Ag nano particles on graphite

Image Conditions:
True Non-Contact
Amplitude (2 nm)
Scan Speed (1 Hz)

System Requirement:
Closed-loop AFM System, Closed-loop Z drive for F-d spectroscopy, SLD Low Coherence Beam Bounce Source, True Non-Contact Mode

The Benefits

The scanner system for AFM has to be precise, linear, and stable in order to perform measurements such as F-d spectroscopy on top of a single nano-particle or nanotube.

Super Luminescence Diode (SLD) utilizes low coherence diode and eliminates optical interference.

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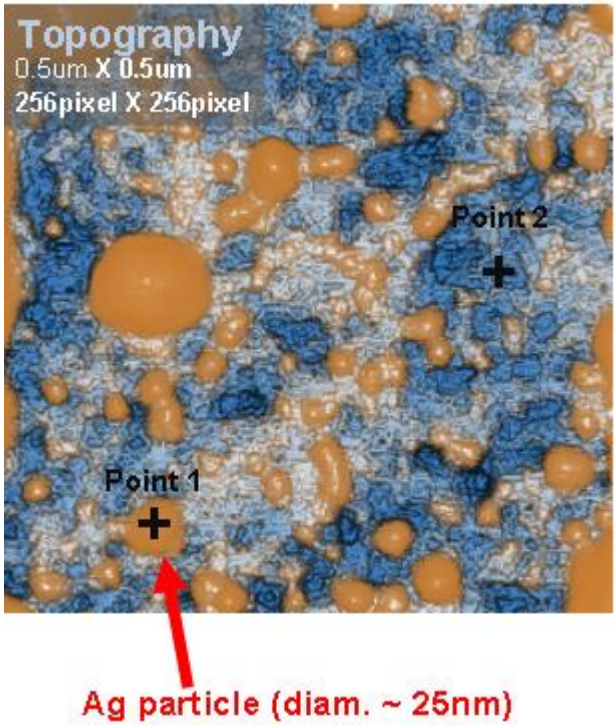
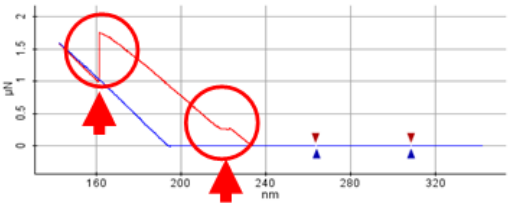
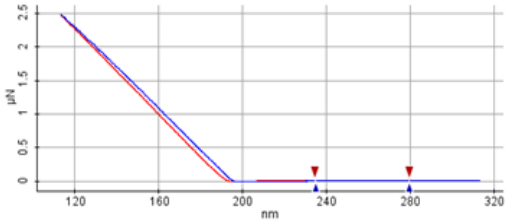


❖ Point 1 F/D on the Ag particle



FD spectroscopy on the Ag particle show aberrations associated with the indentation of the nanoparticle.

❖ Point 2_F/D on the Substrate



FD spectroscopy on the substrate show no effects of indentation.

Relevant Publications using XE-series AFM and F-D Spectroscopy

Qihua Xiong, N. Duarte, S. Tadigadapa, and P. C. Eklund; Force-Deflection Spectroscopy: A New Method to Determine the Young's Modulus of Nanofilaments; Nano Lett., 2006, 6 (9), 1904-1909
Equipment: Park Systems XE-100

Abstract: We demonstrate the determination of Young's modulus of nanowires or nanotubes via a new approach, that is, force-deflection spectroscopy (FDS). An atomic force microscope is used to measure force versus deflection (F−D) curves of nanofilaments that bridge a trench patterned in a Si substrate. The FD data are then fit to the Euler−Bernoulli equation to determine Young's modulus. Our approach provides a generic platform from which to study the mechanical and piezoelectric properties of a variety of materials at the nanoscale level. Young's modulus measurements on ZnS (wurtzite) nanowires are presented to demonstrate this technique. We find that the Young's modulus for rectangular cross section ZnS nanobelts is 52 ± 7.0 GPa, about 30% smaller than that reported for the bulk.