STUDY OF MECHANICAL PROPERTIES OF 1D AND 2D GOLD NANOSTRUCTURES SUPPORTED BY FEM SIMULATIONS

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In recent times the miniaturization of novel electronic devices to the nanoscale has promoted an increase of interest in pure crystalline metallic nanostructures. Such one- and two-dimensional nanostructures have revealed potential for applications in biosensing, nanophotonics, -electronics,-sensors and energy harnessing. In particular, gold nanowires show great promise in nanoelectromechanical systems, due to their excellent mechanical, electrical, thermal and chemical properties. Furthermore, gold 2D nanoplates have been shown to be usable as building blocks for molecular electronics [1], potential as highly efficient chemical and biological sensors [2] and even as chemical catalysts [3].

In this work the AFM based three point bending technique is applied in two different experimental configurations for measuring the mechanical properties of pentagonal Au NWs. The first configuration consisted of NWs being freely suspended over the inner edges of rectangular holes (inverted pyramids) etched into Si. In the second configuration the NWs were suspended over the etched holes and the ends of the NWs were fixed by the high adhesion force acting between NWs and substrate.

Similar AFM based technique is applied for measuring the mechanical response of gold nanoplates. The plates were partly suspended over the trenches and were manipulated from the suspended part. Analytical solutions based on the elastic beam theory and finite element method were employed for evaluating the data obtained from both of the three point bending experimental configurations and the partially suspended plates.

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1. Ultraflat Au nanoplates as a new building block for molecular electronics
2. Shape Transformation of Gold Nanoplates and their Surface Plasmon Characterization: Triangular to Hexagonal Nanoplates
3. Andoy, N. M.; Zhou, X.; Choudhary, E.; Shen, H.; Liu, G.; Chen, P. Single-molecule catalysis mapping quantifies site-specific activity and uncovers radial activity gradient on single 2D nanocrystals. J. Am. Chem. Soc. 2013, 135, 1845-1852.

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