Mechanical properties of semiconductor nanowires

Liga Jasulaneca[1], Raimonds Meija[1], Justin D. Holmes[2], Donats Erts[1]

[1]Institute of Chemical Physics, University of Latvia, Riga, Latvia

[2]Department of Chemistry, National University Ireland, Cork, Ireland

e-mail: liga.jasulaneca@lu.lv

Nanowires (NWs) are one-dimensional nanostructures with perspective applications in electromechanical, optical and magnetic devices. Active research has been devoted to explore possible applications of NWs in switches, nanoresonators, memory elements and sensors. Mechanical properties of NWs have great impact on the speed of operation, durability and stability of nanodevices. Due to their uniform structure and high reproducibility single-crystalline NWs are well-suited for devices applications.

Here we report Young's modulus measurements of single standing Sb_2S_3 and Ge NWs. Transmission electron microcopy revealed that the examined NWs have single-crystalline structure. For mechanical investigation of the NWs in scanning electron microscope (SEM) chamber two different methods were used. *In situ* characterization allowed real-time manipulation and visualization of mechanical testing. NWs were clamped to substrate using electron beam deposition. One method used for mechanical testing was the widely-used electric field-induced mechanical resonance, while the other was static bending of NWs with atomic force microscope (AFM) tip in SEM. Both methods allowed characterization of tensile deformation and determination of corresponding Young's modulus of the individual NWs. The mean value of Young's modulus was compared to that of bulk material.

Participation in EuroNanoForum 2015 is supported by ERAF project No. 2015/0008/2DP/2.1.1.2./14/APIA/VIAA/004