ELASTIC MODULUS OF β-Ga_2O_3 NANOWIRES MEASURED BY RESONANCE AND THREE-POINT BENDING TECHNIQUES

Annamarija Trausa[1] (presenting author), Sven Oras[2,3], Sergei Vlassov[2], Mikk Antsov[4], Tauno Tiirats[3], Andreas Kyritsakis[3], Boris Polyakov[1], Edgars Butanovs[1]

[1]Institute of Solid State Physics, University of Latvia, [2]Institute of Physics, University of Tartu, [3]Institute of Technology, University of Tartu, [4]Estonian Military Academy

e-mail of presenting author: annamarija.trausa@cfi.lu.lv

Significant advancements in material and device technologies related to monoclinic gallium oxide (β-Ga_2O_3) have been made recently [1,2], attracting interest due to its ultra-wide bandgap (4.4–4.9 eV) and chemical stability [3-5]. These applications can be scaled to the nanoscale, including flexible nanodevices. Ga_2O_3 nanowires (NWs) are suitable for bendable and stretchable substrates, aligning with trends in flexible electronic device development [6,7]. Therefore, understanding the mechanical properties of β-Ga_2O_3 NWs, particularly their elastic modulus, is crucial for designing Ga_2O_3-based nanomechanical resonators and flexible field-effect transistors [8]. However, research on the mechanical properties of Ga_2O_3 NWs remains limited.

In this work, we investigated the elastic modulus of individual β-Ga_2O_3 NWs using two distinct techniques - *in situ* scanning electron microscope resonance and three-point bending in atomic force microscope. The resonance tests yielded the mean elastic modulus of 34.5 GPa, while 75.8 GPa mean value was obtained via three-point bending. The measured elastic moduli values indicate the need for finely controllable β-Ga_2O_3 NW synthesis methods and detailed post-examination of their mechanical properties before considering their application in future nanoscale devices.

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