

High-Pressure study of wurtzite InP nanowires

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Abstract

In this project we have studied the structural behaviour of wurtzite-phase (WZ) InP nanowires (NW) containing InAs quantum dots and coated with Sb_2S_3 phase change material (PCM) [Fig. 1a] under high pressure (HP) using a diamond anvil cell, Raman spectroscopy and synchrotron techniques. These hybrid nano-devices hold significant potential as wide-range wavelength-tunable single-photon sources (SPS) in the telecom band. HP Raman spectroscopy [Fig. 1b] and synchrotron XRD measurements performed at ID27 beamline, ESRF, suggest changes in the electronic structure around 3-5 GPa [Fig. 1c] and a wurtzite to rock-salt phase transition of InP in the region of 11-14 GPa, supplementing scarce low pressure measurements [1] and simulations [2]. For the first time, we were able to experimentally determine the bulk modulus of the hexagonal wurtzite phase of InP. Ultimately, these findings will support the development of a wavelength-tunable SPS for quantum technologies based on locally strained PCM.

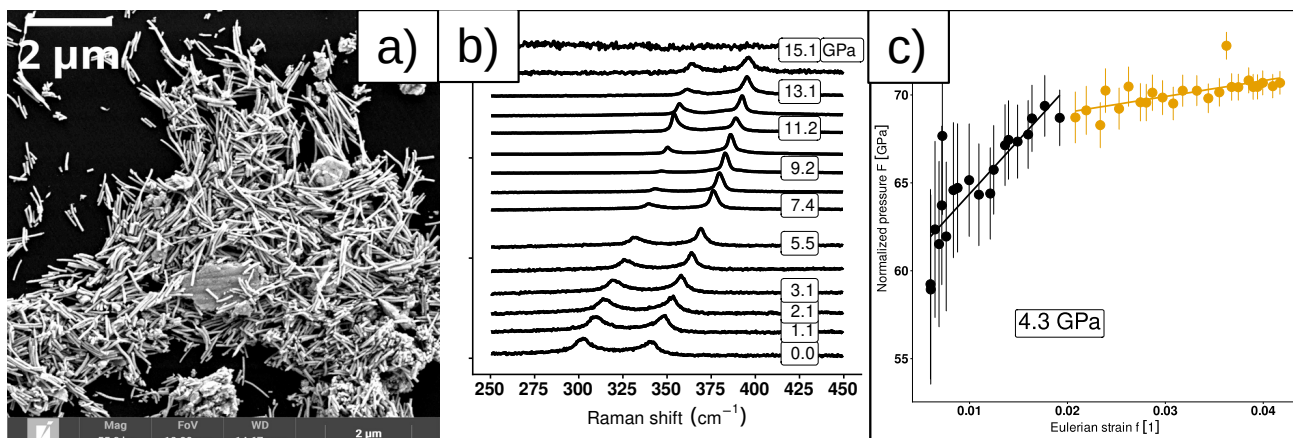


Fig. 1: a) SEM image of WZ InP NWs on a diamond anvil. b) Raman spectra at different pressures. c) Normalized pressure (F) - Eulerian strain variable (f) plot.

References

- [1] N. Chauvin, A. Mavel, G. Patriarche, B. Masenelli, M. Gendry and D. Machon, *Nano Lett.*, **16**, 2926–2930 (2016).
- [2] N. Nayir, E. S. Tasci and S. Erkoc, *IJNT*, **13**, 809 (2016).