Tip-Enhanced Raman Spectroscopy of Semiconductor InP-InGaP hetero-structured Nanowires:

Vanessa Hinojosa Chasiquiza[1]
Irene Mediavilla[1], Juan Jiménez[1], Lukas Hrachowina[2], Magnus T. Borgström[2], and Jorge Serrano[1]*

[1]GdS OPTRONLAB, Dept. of Condensed Matter Physics, University of Valladolid, Edificio LUCIA, Paseo de Belén 19, 47011, Valladolid, Spain
[2]Solid State Physics, Lund University, Box 118, 22100 Lund, Sweden.

Jorge.serrano@uva.es

Abstract

Raman spectroscopy is a powerful technique for the characterization of semiconductors [1,2]. The improvement of the spatial resolution is crucial for the study of semiconductor nanostructures. The cutting-edge technique for scaling down to the nanosize is tip enhanced Raman Spectroscopy (TERS) [2,3].

We present here a TERS analysis of InP/InGaP axially heterostructured Nanowires (NWs) combined with Atomic Force Microscopic technique. Fig. 1 shows the typical spectra of InP, InGaP, and a spectrum corresponding to a tunnel junction in between the InP and the InGaP segments. The green, red, and blue areas correspond to LO GaP like (InGaP), LO InP like (InGaP), and TO (InP) respectively. Those areas of interest were represented along the NWs with the same colors revealing resonances at the tunnel junction (red map) and at the undoped InGaP segment (green map), Fig. 2
This work evidences the potential of TERS for spatially resolved characterization of NW with nanometric resolution, which is very promising for the study of nanostructures for quantum devices.

References

[1] Otnes, G. et al,Nano letters, 18(5) (2018), 3038-3046.
[2] Zhao, Y. et al., Physical Review B, 104(23), (2021) 235309.
[3] Poliani, E., et al., The Journal of Physical Chemistry C, 124(51) (2020) 28178-28185.Authors, Journal, Issue

Figures

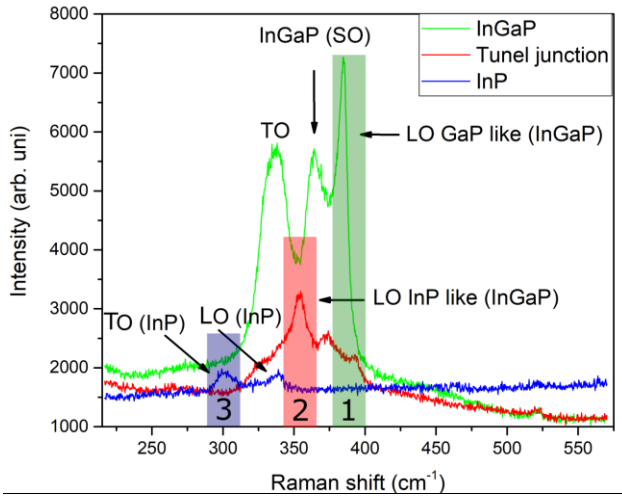

Figure 1: Typical local Raman spectra recorded on the InP, and InGaP segments and the tunnel junction (see Fig.2). The shadowed areas correspond to the spectral windows mapped in Fig.2 .

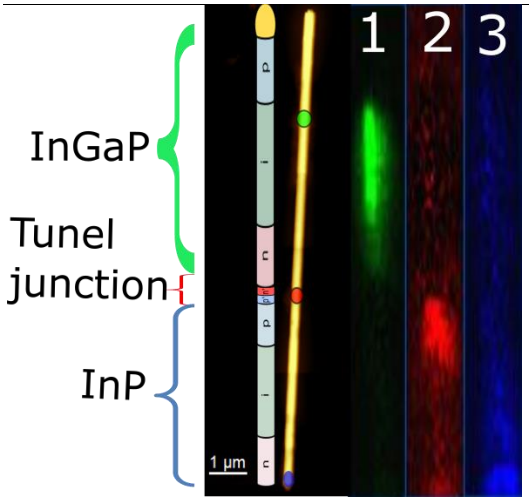

Figure 2: TERS maps along the InP/InGaP nanowire: 1) LO GaP like (InGaP) 2) LO InP like (InGaP) and 3) TO (InP) peaks ,see Fig. 1