Structural studies of PA-MBE ZnO layers doped with antimony

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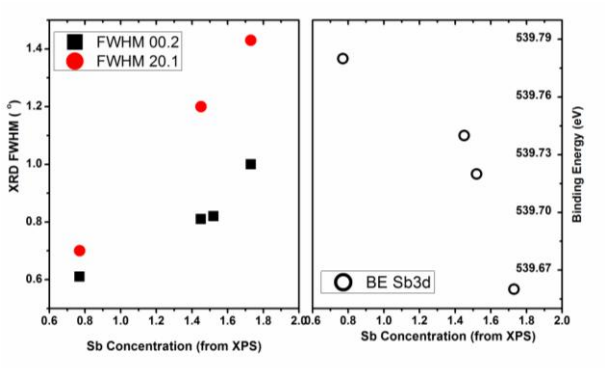
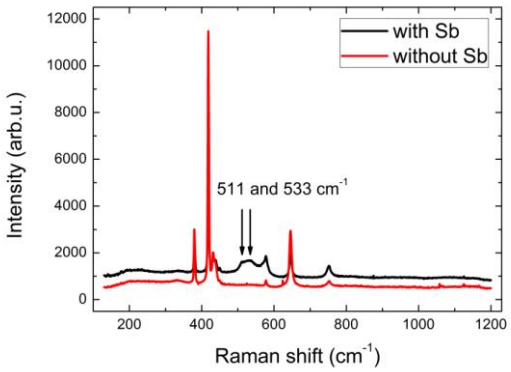
Zinc oxide is a semiconductor with direct wide band-gap of 3.3 eV (at 300 K) and high exciton binding energy at (60 meV at RT), which allows to successfully use it in optoelectronic devices dedicated for UV-blue range. It is a natural n-type semiconductor, which goes hand in hand with issues with doping it for p-type, which results from native defects and low solubility of the p-type dopants in this material. Right now p-ZnO is achievable, but still there is very little known about its structural properties.

In this work we present the results of complex studies on p-ZnO:Sb MBE layers. ZnO samples with varying concentration of Sb dopant were grown on sapphire substrates. Investigation consists of Raman spectroscopy, photoluminescence, X-ray, SIMS and XPS measurements, which provided information about structural properties of the material. Observed FWHM of 00.2 and 20.1 of XRD peaks increase with Sb concentration and at the same time binding energy of XPS Sb3d peak is changing - suggesting change of locations of Sb atoms in the ZnO matrix. Experiment including Raman scattering measurements were conducted using 514 nm Ar^{2+} laser line without polarization detection. Besides typical sapphire and zinc oxide modes, Raman spectra revealed additional modes at 511 and 533 cm^{-1}, associated with the presence of Sb dopants. To complete the overall view on the material properties, Atomic Force Microscope and Scanning Electron Microscope images are also included.





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