GROWTH AND CHARACTERIZATION OF GALLIUM PHOSPHIDE ON GALLIUM OXIDE SUBSTRATE FOR HETEROJUNCTION DIODE

Sebastian Lourdudoss[1], Manavaimaran Balaji[1,2], Axel Strömberg[1], Dhandapani Dhanabalan[3], Sakthivel Raja[3], Sridharan Moorthy Babu[3], Yan-Ting Sun[1]

[1] KTH- Royal Institute of Technology, Stockholm, Sweden, [2] Department of Materials Science, University of Madras, Chennai 600025, India , [3] Crystal Growth Centre, Anna University, Chennai 600025, India

Gallium oxide (Ga_2O_3) is a promising candidate for next generation power electronics. Optical floating zone (OFZ) technique is attractive to grow thermodynamically stabler bulk β-Ga_2O_3 as it offers a crucible-free method and is flexible in growing conducting (n-type) and non-conducting substrates. Ga_2O_3 p-n homojunction is difficult to achieve due to lack of p-type dopant as well as feasible polaronic hole transport. To circumvent it, heterojunction with n-Ga_2O_3 and a p-oxide, e.g., p-NiO has been attempted by Sohel et al. Encouraged by our recently demonstrated heteroepitaxial growth of p-GaP:Zn on Si and GaAs substrates, we attempted for the first time heteroepitaxial growth of GaP by hydride vapour phase epitaxy (HVPE) on OFZ grown n-Ga_2O_3 with the intention of fabricating p-GaP/n-Ga_2O_3.

β-Ga_2O_3 single crystals grown by OFZ technique were cleaved and polished. Unintentionally doped ~5 μm thin GaP film was deposited on the β-Ga_2O_3 substrates at 710 °C in a low pressure (20 mbar) HVPE reactor using GaCl and PH_3 as precursors. The uniform heteroepitaxial layer, confirmed by optical microscope and first of its kind to our knowledge, was characterized by x-ray diffraction (XRD) and Raman spectroscopy. The XRD pattern shows the presence of (111) phase with (002) peak of GaP. Raman spectrum exhibits GaP (TO) and (LO) phonon modes at 369 cm^{-1} and 405 cm^{-1}, respectively. These can be compared to the respective values of 365 cm^{-1} and 402 cm^{-1} observed for epitaxial GaP in the literature.