Semiconductor Nanostructure Design: Bottom-Up Approach via Electrodeposition

Bjoern Seipel PhD, Department of Physics, Portland State University
bseipel@pdx.edu, Phone: (503) 725- 4226

Abstract

This faculty enhancement grant proposal is being submitted in support of Portland State University's nanofabrication and nanometrology initiative for the amount of $12,500. The intention of this project addresses the fabrication and characterization of nanoscale wide band semiconductor structures. The proposed research is build upon preliminary research over the past two years. Nanocrystal growth via a cost effective, low temperature electrodeposition method can be controlled by a set of parameters such as precursor concentration, temperature, or deposition potential. It also allows tailoring nanocrystal morphologies. We now grow rod, needle, belt, disc, sphere and other symmetric nanocrystal morphologies on inexpensive substrates, such as tin oxide coated glass or silicon wavers, respectively. The central objective of this proposal is the elucidation of the various roles of chemical compositions on nucleation on the growth of GaN via elctrodeposition. Electronic properties will be probed using measurements and electroluminescence (EL) measurements and photoluminescence (PL), respectively. Advanced X-ray diffraction (XRD), high-resolution scanning electron microscopy (HRSEM), high-resolution transmission electron microscopy (HRTEM), and electron energy loss spectroscopy (EELS) measurements will be performed to allow the characterization of the grown nanocrystal aggregates. Models of growth kinetics and electronic properties will be derived from growth parameters and dopant levels.

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