Presenter:

Sebastian Gutsch, University of Freiburg

Title:

Characterization of Phosphorus Doped Silicon Nanocrystals Embedded in SiO_2

Abstract:

Phosphorus (P) doped silicon nanocrystals (Si NCs) are prepared by deposition and annealing of P doped silicon-rich oxide / silicon oxide (SiO_2) multilayers. The chemical environment of P is determined from X-ray photoelectron and X-ray absorption near edge spectroscopy. It is found that P is incorporated into the Si NCs down to diameters of about 2.5 nm. However, the results suggest that essentially no free electrons are generated in this doping process. Using atom probe tomography, it is further found that large amounts of the dopants segregate at the Si NC / SiO_2 interface. In addition, photoluminescence spectroscopy and electrical characterization of the multilayers indicate that the majority of incorporated P atoms have only a small impact on the optical and electronic properties. It is shown that less than 1% of the doped P atoms occupy a substituitional site and that the donor ionization energy significantly exceeds kT at room temperature.