Electronic structure of buried semiconductor mono-layer studied Soft-x-ray emission spectroscopy

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Interfaces and buried layers in solids play a very important role in semiconductor technology. For instance, the performance of electronic micro-devices is critically dependent on the electron and hole transport parallel and perpendicular to interfaces. Despite the vital significance of interfaces and buried layers, very little is known about their electronic and atomic structures. We have recently demonstrated that by using soft x-ray emission spectroscopy (SXES), combined with ab initio computations, very detailed information can be extracted about the electronic structure of buried layers. A systematically studied combinations of homo- and heteropolar semiconductors, namely monolayers of Si in GaAs, AlAs in GaAs and Ge in Si. Very good agreement was obtained with ab initio DFT calculations. For Si/GaAs system we were able to determine the distribution of the Si atoms over the GaAs anion and cation states. We also observe a donor state in 1ML of Si just below the bottom of the conduction band.

2. Semiconductors
2.4 Electronic Structure and Optical Properties
2.6 Spectroscopic Properties