Defect cores investigated by x-ray scattering close to forbidden reflections in silicon — TILL H. METZGER\textsuperscript{1}, MARIE-INGRID RICHARD\textsuperscript{2}, VACLAV HOLY\textsuperscript{3}, and KAI NORDLUND\textsuperscript{4} — \textsuperscript{1}ESRF, Grenoble, France — \textsuperscript{2}ESRF/CEA, Grenoble, France — \textsuperscript{3}Charles University, Prague, Czech Republic — \textsuperscript{4}University of Helsinki, Finland

Characterizing the structure of point defects and dislocations and understanding their properties are of great importance in semiconductor technology. In silicon implantation, the interaction of defects and impurities play a crucial role in the doping of silicon. The most important extended defects observed in such systems are stacking faults, "311" defects and perfect dislocation loops. A new x-ray scattering method is presented making possible the detection of defects and the investigation of the structure of their cores. The method uses diffuse x-ray scattering measured close to the (200) forbidden diffraction peak, in which the intensity scattered from the distorted crystal lattice around the defects is minimized. As an example of this non-destructive method the intensity scattered from the distorted crystal lattice around the extended defects observed in such systems is measured close to the (200) forbidden diffraction peak, in which the intensity scattered from the distorted crystal lattice around the defects is minimized. The experimental results are found to be in very good agreement with atomistic simulations [1]. [1] M.I. Richard, T. H. Metzger, V. Holy and K. Nordlund, accepted for publication in Phys. Rev. Lett. 2007

Application of evolutionary strategies to the analysis of defects in semiconductors — SILVIA SCHUMANN\textsuperscript{5} and TOFRSTEN HANS\textsuperscript{6} — \textsuperscript{1}TU Bergakademie Freiberg, Institute for Theoretical Physics, Leipziger Str. 23, 09599 Freiberg, Germany — \textsuperscript{2}TU Bergakademie Freiberg, Institute for Experimental Physics, Leipziger Str. 23, 09599 Freiberg, Germany

This work presents an application of evolutionary strategies to the analysis of defects in semiconductors. Experimental Photo-Induced Current Transient Spectroscopy (PICS) measurements have been simulated at different levels of optical excitation. These simulations give access to various physical properties like e.g. the minority carrier lifetimes. This enables us to compare directly the simulated data to quasi steady state photoconductance and PICS-measurements at different injection levels. The evolutionary strategy was chosen because of the high dimension of the problem and the unknown landscape of the objective function. The application of the evolutionary algorithm provides the defect configurations, where each defect is characterized by its energy, concentration, and capture cross-section. Suitable configurations in very good agreement with experimental data can be obtained already after a few generations. The evolutionary algorithm avoids trapping in local minima and provides information on the range of possible solutions.

Probing the free charge carrier distribution with non-contact and contact AFM — A.-D. MÜLLER\textsuperscript{7}, F. MÜLLER\textsuperscript{7}, S. JANSSCH\textsuperscript{7}, C. HENKEL\textsuperscript{7}, P. PELZING\textsuperscript{7}, A. MÖLLER\textsuperscript{7}, and H. SCHMIDT\textsuperscript{7} — \textsuperscript{1}Anfatec Instruments AG, Melanchthonstrasse 28, D-08606 Oelsnitz — \textsuperscript{2}Technische Universität Leipzig, Institut für Experimentelle Physik II, D-04103 Leipzig — \textsuperscript{3}SGS Institut Fresenius GmbH, D-01109 Dresden — \textsuperscript{4}Forschungszentrum Dresden-Rossendorf e.V., D-01314 Dresden

We address the issue of extracting the dopant profile information on the nanoscale by electrostatic force microscopy (EFM) in non-contact and Scanning Capacitance Microscopy (SCM) in contact mode. Cross sections prepared of Si epilayers on Si substrates were investigated with highly-doped conductive tips in complementary SPM techniques with a lateral resolution limited by the Debye length. Frequency and tip-sample distance dependent surface work functions were obtained by Kelvin Probe Force Microscopy (KPFM) with a voltage resolution better than 10 meV. Surface band structures in the frequency range between 10 kHz and 300 kHz are acquired by non-contact capacitance detection in dynamic EFM, while high-frequency tip-sample capacitance-voltage characteristics have been detected by a SCM sensor and enable the determination of dopant concentration. The comparison between these techniques is completed by numerical simulations of voltage dependent tip-sample capacitances to improve the understanding of the contrast. The recorded KPFM and SCM data are complementary with respect to surface and depth resolution, respectively, and together they give a more complete impression of the sample’s electronic structure.