DS 7 Ionenstrahlverfahren I

Zeit: Samstag 13:45–15:00 Raum: TU H107

Hauptvortrag DS 7.1 Sa 13:45 TU H107

The role of ion irradiation induced viscous flow in thin film structuring: Hard matter going soft — •S.G. Mayr — I. Physikalisches Institut, Georg–August–Universität Göttingen, Friedrich–Hund–Platz 1, 37077 Göttingen

Ion beams provide unique opportunities for modifying thin film structural and mechanical properties on length scales ranging from several nanometers to macroscopic dimensions. In a variety of materials, including polycrystalline and amorphous metals and semiconductors, plastic effects can dominate, which originates from processes in the small volumes of materials affected by a single ion impact. The underlying atomic–scale kinetics as well as its applications for self–organized structuring are investigated using a combination of experiments and molecular–dynamics (MD) computer simulations: We report experiments, that illustrate the impact of radiation induced viscous flow on morphology and stresses, such as interface smoothing [1], stress relaxation, radiation induced sintering or self–organized pattern formation. Using MD simulations [2] we study the underlying atomic–scale mechanisms for the two energy regimes, where local melting along the ion track is either dominant or not. We show, that macroscopic plastic flow does not require melting, indicating, that defect–like entities are sufficient to mediate plastic flow.
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[1] S.G. Mayr and R.S. Averback, Phys. Rev. Lett. 87 (2001), 196106
[2] S.G. Mayr, Y. Ashkenazy, K. Albe and R.S. Averback, Phys. Rev. Lett. 90 (2003), 55505

DS 7.2 Sa 14:30 TU H107

Formation of magnetic nanoclusters in crystalline silicon by ion implantation — •O. Picht[1], W. Wesch[1], E. Wendler[1], N.A. Sobolev[2], M.M. Araújo Oliveira[2], and J. Heinrich[3] — [1]Institut für Festkörperphysik, Friedrich-Schiller-Universität Jena — [2]Departamento de Física, Universidade de Aveiro, Portugal — [3]Innovent Jena

The research interest on magnetic semiconductors has been strongly increased over the last few years. While the focus mostly rested on the doping of II-VI and III-V compound semiconductors with transition metal ions such as Fe, Co, Ni and mainly Mn, there are only few publications on group IV semiconductors like Si and Ge. The formation of magnetic structures is mostly accomplished by chemical vapor deposition, molecular beam epitaxy or ion implantation. With the latter technique we consecutively implanted As and Mn ions at high fluences of $2 \cdot 10^{16}$ at/cm^2 into weak p-type Si (100). The implantation was carried out at a temperature of 350°C and with energies of 200 keV (Mn) and 270 keV (As). After implantation, rapid thermal annealing (RTA) was carried out at 1100°C for a time span of 30 s. Our Rutherford backscattering spectrometry (RBS) measurements indicate that a strong redistribution of both species takes place during the annealing processes. Whilst the As ions are partially incorporated into the Si-lattice and their movement seems to be governed mainly by diffusion, the Mn ions depth distribution shows additional peaks, resulting from nucleation at defect structures. The Ferromagnetic Resonance (FMR) and SQUID-measurements show ferromagnetic behaviour and suggest a Curie-Temperature over 300 K.

DS 7.3 Sa 14:45 TU H107

Sauerstoffdiffusion und Phasenbildung in dünnen Eisenoxidschichten unter Bestrahlung mit schnellen schweren Ionen — •Tobias Roller, Tilman Joachim Renz, Hartmut Paulus und Wolfgang Bolse — Institut für Strahlenphysik, Universität Stuttgart

Die Bestrahlung von Eisenoxid-Schichtsystemen mit hochenergetischen schweren Ionen (MeV/amu) führt zu einer Verlagerung von Sauerstoff und der Bildung neuer Oxidphasen in unterschiedlichen Tiefen der Probe. So wurde z.B. an unterstöchiometrischen FeO_x-Schichten (x<1) bei deren Bestrahlung mit 350 MeV Au^{26+}-Ionen beobachtet, dass der oberflächennahe Bereich oxidiert und die darunter liegende Schicht teilweise reduziert wird. Mit zunehmender Bestrahlungsfluenz wandert die Grenze zwischen diesen Bereichen in größere Tiefen.

Zur Untersuchung der Phänomene wurden Rutherford Backscattering Spectroscopy (RBS), Elastic Recoil Detection Analysis (ERDA) und Mößbauerspektroskopie eingesetzt. Mit Hilfe von isotopisch markierten Schichten (^{18}O, ^{16}O) wurde die Herkunft des Sauerstoffs genauer untersucht.