# DS 13 Ionenstrahlverfahren II

Zeit: Montag 14:15–15:15 Raum: TU H107

DS 13.1 Mo 14:15 TU H107

**Topography of simultaneously sputtered and rotated solid surfaces: A numerical study** — •Emmanuel O. Yewande, Reiner Kree, and Alexander K. Hartmann — Institut für Theoretische Physik, Universität Göttingen

Rippled topography that arises from the bombardment of solid surfaces by beams of oblique incidence ions, is undesirable in the dopant profiling of semiconductors since the periodic height modulations lead to a rapid degradation of depth resolution during depth profiling. This problem can be overcome, as demonstrated experimentally [1] and theoretically [2], by Zalar rotation which ensures that the surface remains smooth as it is rotated during erosion. Furthermore, it has been observed [3] that such simultaneously rotated and sputtered surfaces evolve some characteristic lengthscales. By means of a SOS model of ion-beam surface sputtering [4, 5], we performed a numerical investigation of the effects of sample rotation, during ion bombardment, on the surface topography. Our analysis, at different angles of incidence, includes the time evolution of the rms fluctuation in the surface height, and the height-height correlation function. [1] E. -H. Cirlin, J. J. Vajo, R. E. Doty, and T. C. Hasenberg, J. Vac. Sci. Technol. A **9**, 1395 (1991). [2] R. M. Bradley, PRE **54**, 6149 (1996). [3] F. Frost, A. Schindler, and F. Bigl, PRL. **85**, 4116 (2000). [4] A. K. Hartmann, R. Kree, U. Geyer, and M. Kölbel, PRB **65**, 193403 (2002). [5] E. O. Yewande, A. K. Hartmann, and R. Kree, cond-mat/0405363.

DS 13.2 Mo 14:30 TU H107

**Ion induced pattern formation on Ge and Si surfaces** — •Bashkim Ziberi, Frank Frost, and Bernd Rauschenbach — Leibniz-Institut für Oberflächenmodifizierung e. V., Permoserstrasse 15, D-04318 Leipzig

Pattern formation during low-energy ion beam erosion can be observed on various semiconductor surfaces and is related to the complex interplay between surface roughening by ion erosion and surface smoothing by different surface relaxation mechanisms. This formation of regular structures with nanometer dimensions (structure dimensions $< 100$ nm) originated from self-organization processes during ion beam erosion offers a promising tool for large-area nanostructured surfaces. For the technologically most important semiconductor materials Ge and Si the topography evolution during low-energy noble gas ion bombardment was investigated and analyzed by high resolution scanning force microscopy (AFM). Depending on ion beam parameters, i. e. ion energy, ion incidence angle and ion mass, different patterns can evolve on the surface. For example in the case without sample rotation, at small ion incidence angles (5° - 15° with respect to surface normal), very well ordered ripple patterns with wavelength $\approx 50$ nm can form in both materials for similar sputtering conditions. However, highly ordered nanostructures on Ge surfaces can be only observed under bombardment with $Xe^+$ instead of $Ar^+$ ions.

DS 13.3 Mo 14:45 TU H107

**Smoothening, mixing and sputtering of semimetal- and halogenide-coatings by swift heavy ion irradiation** — •Hartmut Paulus, Wolfgang Bolse, and Bouschaib Bahouchi — Institut für Strahlenphysik, Stuttgart

Thin layers of Bismuth and several Halogenides have been deposited onto Silicon and Silicon Oxide substrates by thermal evaporation at different substrate temperatures. The samples were irradiated with different swift heavy ions (SHI) of various energies and fluences at a temperature of about 80K. After irradiation the irradiated as well as the remaining non-irradiated parts of the samples were characterized by surface profilometry (SP) and Rutherford backscattering spectrometry (RBS). From the RBS data the thickness of the coating can be determined. The combination of SP and RBS allows to distinguish between surface roughness and interface mixing. It is well-known that depending on the deposition conditions these materials exhibit a more or less rough surface, which in fact was also observed in our case. The irradiation with SHI results in 3 different effects. At low fluences smoothening, which is probably due to compaction of the material (reduction of the interface variances in the RBS spectra), occurs. Higher fluences on the other hand lead to significant intermixing of the coating with its substrate (increase of the interface variances in the RBS spectra). At very high fluences also sputtering can be observed. These effects will be discussed in terms of transport of matter in ion tracks.

DS 13.4 Mo 15:00 TU H107

**Einfluss der Substrattemperatur und der Substratvorstrukturierung auf das 3D-Nanostrukturwachstum bei der Ionenstrahl-Sputterabscheidung mit GLAD** — •John Fahlteich, Eva Schubert, Bernd Rauschenbach und Thomas Höche — Leibniz-Institut für Oberflächenmodifizierung e.V. (IOM), Permoserstrasse 15, 04318 Leipzig

Durch extrem flachen Teilcheneinfall bei geeigneter Substratrotation lassen sich dreidimensionale Nanostrukturen mit vielfältiger Geometrie auf einem Silizium(Si)-Target erzeugen. Es wurde untersucht, wie sich Temperatur und Substratvorstrukturierung auf das Wachstum vierzähliger Spiralen auswirken. Als Vorstrukturen dienten Si-Punktstrukturen oder zusätzlich aufgetragene Goldpartikel. Für das Strukturwachstum wurde ein Si-Target mit Argon(Ar+)-Ionen beschossen. Die zerstäubten Si-Atome gelangten unter einem Winkel von 85° auf das Substrat, wobei das Stukturwachstum in einem Temperaturbereich zwischen Raumtemperatur und 400°C untersucht wurde. Zur Erzeugung der Spiralen wurde ein Si-Substrat in Schritten von 90° azimutal gedreht und ein Spiralarm für jeweils 45 min bei feststehendem Substrat gewachsen. Die Nanostrukturen wurden mit Hilfe eines Rasterelektronenmikroskops (REM) hinsichtlich ihres Aufbaus, Abstands und ihrer Größe untersucht. Es wird gezeigt, dass bei zunehmender Temperatur der Durchmesser der Strukturen deutlich kleiner wird. Die Größe und Anordnung der Nanospiralen hängt zudem vom räumlichen Arrangement und der Größe der Vorstrukturen auf dem Substrat ab. Die Analyse der kristallographischen Struktur erfolgte mit Röntgenbeugung (HR-XRD).