DS 14 Growth of thin films

Time: Wednesday 14:00–15:15 Room: GER 38

DS 14.1 Wed 14:00 GER 38

Sputtering of Cr-Mn-O thin films — •Philip Dellinger and Dieter Mergel — Thin film working group, Physics Department, University Duisburg-Essen, 45117 Essen

Thin films have been prepared by rf-diode sputtering of a Cr_2MnO_4 target. Substrate temperature and oxygen content in the sputter gas have been varied.

The packing density of the films increases with increasing substrate temperature. The refractive index at 1000 nm, as obtained from transmittance measurements by dielectric modelling, varies between 2.2 and 2.7.

The x-ray diffractograms do not allow a unique interpretation. Some samples exhibit only peaks that are unambiguously due to Cr_2O_3. Other samples are 'mixed' in that they exhibit peaks that could be attributed to Cr_2O_3 as well as to Cr_2MnO_4. EDX-analysis gives a nearly stoichiometric ratio of [Cr]/[Mn] of 2/1 for all samples. The Raman spectra of the two groups of samples do not show significant differences.

DS 14.2 Wed 14:15 GER 38

Effect of substrate temperature and thickness on nano-structure of UHV deposited Titanium thin films — •Mehran Gholipour[1], Hadi Savaloni[1], and Michael Antony Player[2] — [1]Department of Physics, University of Tehran, North-Kargar Avenue, Tehran ,Iran — [2]Department of Engineering, University of Aberdeen, Aberdeen AB24 3UE, U.K

The effect of substrate temperature and film thickness on microstructure of Titanium thin films is investigated. Titanium thin films were deposited on glass substrate at different substrate temperatures in the range of 313 to 600 K with different thickness in the rang of 20-240 by electron beam evaporation using a Balzers UMS 500U UHV. Deposition rate was 0.29 Ås-1 and monitored by a quadruple mass spectrometer and controlled by feedback to the evaporation source. Crystallite sizes (size of coherently diffracting domains) and micro-strain are evaluated using Scherrer and Stocks-Wilson relations, Double-Voigt (DV) and Warren-Averbach (WA) methods. Results show that Ti samples are oriented in (002) direction at low thickness and substrate temperature and preferred orientation changed to (101) at highest thickness and substrate temperature. Crystallites size of Ti samples increased with temperature, thickness but micro-strain and lattice constants decrease with thickness. Crystallite sizes distribution function was obtained from the size broadened part of DV function, and results show a shift in the maximum to larger sizes with increasing the temperature and thickness. Keywords: size-strain analysis; XRD; Warren-Averbach; Double-Voigt

DS 14.3 Wed 14:30 GER 38

Deposition rate and thickness dependence of nano-structure of UHV deposited silver thin films — •Mehran Gholipour Shahraki[1,2], Hadi Savaloni[1,2], and Michael Antony Player[3] — [1]Plasma Physics Research Center, Science and Research Campus of I. A. University, P. O. Box 14665-678, Tehran, Iran — [2]Department of Physics, University of Tehran, North-Kargar Avenue, Tehran ,Iran. — [3]Department of Engineering, University of Aberdeen, Aberdeen AB24 3UE, U.K.

Silver thin films of different thickness were deposited on float glass substrate at different deposition rates ranging from 0.4 to 22.5 $Ås^{-1}$ by electron beam evaporation using a Balzers UMS 500U UHV at substrate temperature of 313 K. Preferred orientation, crystallite sizes (size of coherently diffracting domains) and micro-strain, stacking and twin faults probability are evaluated using Scherrer-Williamson-Hall plot, Single Voigt and Double-Voigt methods. XRD analysis of Ag samples showed that Ag samples are oriented in (111) direction normal to the substrate surface. Results show that the Crystallite sizes increase with deposition rate while micro-strain and lattice constants decrease with thickness. Crystallite sizes distribution function was obtained from the size broadened part of DV function, and results show a shift in the maximum to larger sizes with increasing the thickness and deposition rates. Keywords: size-strain analysis; Silver thin films; XRD

DS 14.4 Wed 14:45 GER 38

Control of pattern formation in ultrathin polyethyleneoxide films — •Hans-Georg Braun and Evelyn Meyer — Leibniz Institute of Polymer Research / Max Bergmann Center of Biomaterials, D-01069 Dresden, Hohe Strasse 6

Ultrathin polymerfilms (thickness < 5 nm) of crystallisable polymers as for example polyethyleneoxide (PEO) can crystallize in highly branched lamellae patterns which result from a diffusion controlled growth process. We demonstrate the control of the nucleation process for dendritic growth by surface defects such as surface steps, edges or rims resulting from thin film dewetting and demonstrate the connection between dewetting structures and crystallization behaviour (1). By surface heterogenization we were able to control the initial dewetting process of thin PEO films and to generate micropatterned amorphous films. The amorphous regions could be nucleated to start dendritic growth by AFM contact. Dendritic growth within confined geometries strongly influences the growth pattern through change of the diffusion conditions inside the lateral confined layers. The dendritic PEO films can act as substrates for electron beam lithography because the material crosslinkes during irradiation and becomes permanently anchored to the surface. 1) E. Meyer, H.-G. Braun J.Phys:Condens. Matter 17 (2005) S623-635

DS 14.5 Wed 15:00 GER 38

Electrical transport mechanisms in growing Pd thin films - modified by hydrogen loading — •Stefan Wagner, Olof Dankert, and Astrid Pundt — Institut für Materialphysik, Georg- August- Universität Göttingen, Friedrich- Hund- Platz 1, 37077 Göttingen

During thin film growth the electrical resistivity of the film changes within orders of magnitude. Different conduction mechanisms can be identified, dominating the conductivity in the different stages of growth. These stages depend on the substrate that, on the one hand, modifies the shape of the islands and, conversely, contributes differently to the condution mechanisms.

Resistance measurements during thin film growth are presented and divided into regimes where charge tunnelling, island percolation and thin film properties are dominating.

The influence of hydrogen loading on the conduction behaviour of a discontinuous film is shown and appears strongly substrate dependent. It will be discussed in terms of magnitude, reversibility and switching time.