DS 2 Elektrische und optische Schichteigenschaften

Zeit: Freitag 10:45–12:00 Raum: TU H107

DS 2.1 Fr 10:45 TU H107

ESR investigation of a donor-like state in epitaxial Si layers — •Kai Petter, Björn Rau, Klaus Lips und Walther Fuhs — Hahn-Meitner-Institut, Abteilung Silizium-Phovoltaik, Kekuléstr. 5, 12489 Berlin

Epitaxial silicon layers ($\sim$ 1 μm thick) grown by electron cyclotron resonance chemical vapour deposition (ECR-CVD) are investigated by Electron Spin Resonance (ESR). The ESR spectra are dominated by two resonances at g=2.006 and 1.999. Here, we investigate the resonance at g=1.999, a localised state near the conduction-band. The spin density of this resonance at 5K is approximately equal to the charge carrier concentration at room temperature. When the samples are excited by above-bandgap light, the ESR signal increases and saturates for high light intensities. The increase and the saturation light intensity are, however, different for different samples. These results can be explained in a model of an n-type semiconductor with different concentrations of compensating acceptors where the ESR resonance is caused by occupied donors. Based on this model we show to which degree our measurements can be used to determine the concentrations of donors and acceptors and therefore the level of compensation in our material. The limitations that arise from the fact that the concentrations of the occupied acceptors are not accessible by our measurements will also be discussed.

DS 2.2 Fr 11:00 TU H107

Photochromism in thin films of nitrospirobenzans — •Michael Karcher und Paul Fumagalli — Freie Universität Berlin

The photochromism of 1',3',3'-trimethyl-6-nitrospiro[2H-benzopyran - 2,2'-indoline] (NO_2BIPS) in solution has been extensively studied.[1-4] Now we have succeeded to create thin films (about 80 nm thick) of NO_2BIPS by evaporation of powder from a stainless steel crucible at 160°C in high vacuum at a base pressure of $2 \cdot 10^{-7}$ mbar. We observed photoswitching behaviour on irradiation of ultraviolet light in these films and compared it to the behaviour in solution using UV-VIS-spectroscopy.

[1] J. B. Flannery, Jr., *J. Amer. Chem. Soc.* **1968**, *90*, 5660-5671
[2] T. Bercovici, T. Heiligman-Rim, E. Fischer, *Mol. Photochem.* **1969**, *1*, 23
[3] A. K. Chibisov, H. Görner, *J. Phys. Chem. A* **1997**, *101*, 4305-4312
[4] H. Görner, *Phys. Chem. Chem. Phys.* **2001**, *3*, 416-423

DS 2.3 Fr 11:15 TU H107

Effect of hot landing at elevated temperature and metal concentration on the optical and electrical properties of teflon AF -noble metal composites — •Haile Takele, Ulrich Schürmann, Henry Greve, Vladimir Zaporojtchenko, and Franz Faupel — Lehrstuhl für Materialverbunde, Technische Fakultät der CAU Kiel, Kaiserstr. 2, 24143 Kiel, Germany

Metal-Polymer nanocomposite films with embedded gold and silver nanoparticles were prepared by a vapor phase co-deposition technique in a high vacuum system[1,2]. The effect of hot landing at elevated temperature during deposition on the microstructure of the composite films was investigated using top view and cross-sectional transmission electron microscopy. The resulting changes in the optical properties of the composites as function of the substrate temperatures were studied using UV-Visible spectroscopy. A large shift of the surface plasmon peak position and a sharp transition in the electrical properties of the composites from insulator to conductor near the percolation point were observed for samples having a metal volume fraction ranging from 0.15 to 0.75. The metal volume fraction was measured by using SEM/EDX. Photoelectron spectroscopy and Fourier transform infrared spectroscopy are also applied to study the chemical composition and structure of the composite.

[1] A. Biswas, O. C. Aktas, J. Kanzow, U. Saeed, T. Strunkus, V. Zaporojtchenko, F. Faupel, Materials Letters, 58, 1530 (2004).

[2] A. Biswas, O. C. Aktas, U. Schürmann, U. Saeed, V. Zaporojtchenko, and F. Faupel,Appled Physics Letters 84, 2655 (2004).

DS 2.4 Fr 11:30 TU H107

Elektromigration in (Nano)- Leiterbahnen mit Engstellen und Inseln — •Burkhard Stahlmecke und Günter Dumpich — Experimentalphysik, AG Farle, Universität Duisburg-Essen (Standort Duisburg), Lotharstrasse 1, 47057 Duisburg

Das Elektromigrationsverhalten von Gold-Nanoleiterbahnen mit vorgegebenen Engstellen und kreisförmigen Aussparungen wurde in-situ in einem hochauflösenden Rasterelektronenmikroskop (HRSEM) untersucht. Desweiteren wurden mit Goldstreifen beziehungsweise Inseln bedeckte Platinleiterbahnen hergestellt, um zu untersuchen, ob Elektromigration an den Goldstrukturen auftritt. Die Herstellung der Nanoleiterbahnen erfolgte mittels Elektronenstrahllithographie (EBL). Die Untersuchungen an Goldleiterbahnen (Länge l = 10 μm, Breite b = 1 μm, Schichtdicke t = 30 nm) mit Engstellen von 500 nm zeigen, dass Voidbildung vermehrt vor der Engstelle / Aussparung stattfindet. Dagegen bilden sich die zugehörigen Hillocks unmittelbar in der Engstelle, d.h. überraschenderweise im Gebiet mit höchster Stromdichte.

Gefördert durch die DFG im Rahmen des SFB 616.

DS 2.5 Fr 11:45 TU H107

Controlled syntheses of silver/polymer nanocomposite films by co-sputtering from two magnetron sources — •Ulrich Schürmann, Whitney Hartung, Haile Takele, Vladimir Zaporojtchenko, and Franz Faupel — Lehrstuhl für Materialverbunde, Technische Fakultät der CAU Kiel, Kaiserstr. 2, 24143 Kiel, Germany

We present a study of the physico-chemical properties of thin polymer films with embedded silver nanoparticles. These films were deposited by co-sputtering from two magnetron sources. The deposition rates were monitored by quartz crystal microbalances, which were calibrated by measuring film thickness after deposition with a profilometer. To study optical and electrical properties, nanocomposites with thickness of some hundred nanometers were deposited on different substrates. The metal volume fraction was monitored by SEM/EDX using a metal/polymer standard, which was calibrated gravimetrically. We characterized the chemical composition and the structure of the composites by using TEM, XRD, XPS and FTIR. Electrical properties of the composite material were studied at different metal filling factors and temperatures. We observe a sharp change in the resistivity over 10 orders of magnitude near the percolation threshold. Marked difference in the UV/Vis-spectra depending on metal concentration, particle size and density were observed. The optical absorption shows a red shift of the absorption peak from 405 nm to more than 500 nm at higher silver content.