

DS 19 Schichtabscheidung

Zeit: Dienstag 13:45–15:15

Raum: TU H107

Hauptvortrag

DS 19.1 Di 13:45 TU H107

In-situ-Charakterisierung der Schichtabscheidung mit gepulsten Magnetrons — •THOMAS WELZEL — TU Chemnitz, Institut für Physik, 09107 Chemnitz, Germany

In den letzten Jahren hat die Schichtabscheidung mit gepulsten Magnetronentladungen im kHz-Bereich stark an Bedeutung gewonnen. Durch den Pulsbetrieb ist ein stabiler Betrieb der Entladung auch in reaktiver Umgebung möglich, da isolierende Schichten in der Pulspause entladen werden. So können Schichten verbesserter Qualität abgeschieden werden, wobei noch nicht geklärt ist, was außer der Arc-Unterdrückung diese Verbesserung bewirkt. Um diese Mechanismen untersuchen zu können, werden In-situ-Diagnostiken benötigt, die die gepulste Entladung zeitaufgelöst messen. Zwei Möglichkeiten sind dabei Langmuir-Sonden und die optische Emissionsspektroskopie (OES). Deren zeitaufgelöste und statische Anwendung auf die Magnetronentladungen der MgO - und TiO_2 -Abscheidung wird vorgestellt. Es wird gezeigt, dass die Plasmaparameter zwar durch die Targetspannung bestimmt sind, jedoch kein einfaches Abbild dieser darstellen, sondern sich komplexe, charakteristische Strukturen im Zeitverhalten bilden, die eine Prozessbeschreibung nur aus gemittelten Größen unmöglich machen.

DS 19.2 Di 14:30 TU H107

The preparation of diamond / tungsten carbide composite films by microwave plasma assisted chemical vapour deposition (MWCVD) — •HISHAM ABU SAMRA¹, SRIKANTH VADALI¹, XIN JIANG¹, and HANS-JOERG DEISEROTH² — ¹Lehrstuhl fuer Oberflaechen und Werkstofftechnologie, Institut fuer Werkstofftechnik. Universitaet Siegen. Paul-Bonatz-Strasse 9-11, D-57068 Siegen, Deutschland — ²Institut fuer Anorganische Chemie. Adolf-Reichwein-Straße, 57068 Siegen Deutschland

Diamond / tungsten carbide composite films were prepared by microwave plasma assisted chemical vapour deposition (MWCVD) using a gas mixture of WCl_6 - CH_4 - H_2 . The tungsten carbide phase consisted of WC and W_2C . The films were deposited on silicon, tungsten and tungsten carbide/cobalt substrates and studied by scanning electron microscopy and grazing-angle X-ray diffraction. The influence of process parameters, such as gas flow rates, substrate temperature and pressure on the volume fractions of tungsten carbide and diamond as well as the surface morphology were investigated. The work shows that it is possible to deposit tungsten carbide and diamond composite in a single process, whereby the volume fractions of WC, W_2C and diamond can be varied by controlling the WCl_6 / CH_4 mole ratio in the gas mixture. Based on these results, a film with a gradient compositional change normal to the substrate surface can be deposited in a single process. Such a tailor-made interlayer can serve as a diffusion barrier as well as improve the adhesion of a diamond film on a non-diamond substrate.

DS 19.3 Di 14:45 TU H107

Physics of the formation of polycrystalline silicon thin films by aluminum-induced layer exchange — •JENS SCHNEIDER, JULIANE KLEIN, ANDREY SARIKOV, MARTIN MUSKE, STEFAN GALL und WALTHER FUHS — Hahn-Meitner-Institut Berlin, Kekuléstr. 5, 12489 Berlin, Germany

Polycrystalline silicon (poly-Si) thin films on foreign substrates are of great interest for large area electronic devices such as solar cells. Recrystallization of amorphous silicon (a-Si) is one approach to achieve such films. The use of in-expensive substrates like glass limits the process temperature to below the glass softening point at around 650°C. Solid phase crystallization (SPC) at these low temperatures is very slow and thus alternatives are searched for. Metals in contact with a-Si have been shown to reduce crystallization times. In metal-induced crystallization (MIC) silicide and non-silicide forming metals are distinguished. The use of Al (non-silicide forming) allows for an aluminum-induced layer exchange (ALILE) process. In ALILE a-Si/Al bi-layers are annealed below the eutectic temperature of Si and Al. The layers exchange position with a concurrent crystallization of silicon.

Here experimental results giving insight into the physics of the layer exchange are presented. The role of the initial a-Si/Al interface as well as the temperature influence is elucidated and their interaction explained. The process is discussed in the phase diagram. Classical nucleation theory is used to interpret the results.

DS 19.4 Di 15:00 TU H107

Investigation of a pulsed magnetron discharge by time-resolved diagnostics — •THORALF DUNGER, THOMAS WELZEL, STEPHAN WELZEL und FRANK RICHTER — TU Chemnitz, Institut für Physik, 09107 Chemnitz, Germany

An asymmetric bipolar pulsed magnetron sputtering process with a Mg target in Ar/O_2 was investigated by time-resolved Langmuir double probe measurements and optical emission spectroscopy (TrOES).

In the "on phase", the charge carrier density $n(t)$ shows two initial maxima followed by a transition into a stationary state. Both height and temporal position of the maxima were found to be influenced by the pulse parameters. In the "off phase", the charge carrier density decreases exponentially with typical time constants of 0.5 μs . The second maximum is mainly influenced by the reverse time which is related to the residual charge carrier density at the end of the "off phase".

With TrOES, the most intense Ar and Mg emission lines were studied. Their temporal behaviour is comparable to that of the charge carrier density. However, the maxima appear usually somewhat after those of the charge carrier density and the decay constants are larger. These differences depend on the particular emission line due to differences in the excitation mechanisms. It was found, that the Ar 750.4 nm line is best suited for a comparison to the charge carrier density.