P 21: Poster: Plasma-Wall Interaction

Time: Monday 16:00–18:00 Location: Lichthof

P 21.1 Mo 16:00 Lichthof

De-excitation of metastable nitrogen molecules on surfaces - Quantum kinetic modeling — •Johannes Marbach, Franz Xaver Bronold, and Holger Fehske — Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, 17489 Greifswald, Germany

Secondary electrons emitted from plasma boundaries are generally very important for the operation of a gas discharge. There is for instance experimental evidence that the stability of the diffusive mode of dielectric barrier discharges is controlled by seed electrons at the electrodes [1]. However, up to now it is not clear how these electrons are made available on the microscopic scale. One possibility is the de-excitation of metastables at the boundary with subsequent release of electrons. To model this intrinsic non-equilibrium process we employ the Keldysh Green's function technique which in principle enables us to calculate the de-excitation probability of the metastable molecules as well as the number of electrons emitted from the surface. As a preparatory step we investigate the de-excitation of metastable nitrogen $A^3\Sigma_u^+$ molecules impacting on an ideal aluminium surface. For this special situation there is detailled experimental and theoretical data available which we use to validate our methodology.

[1] R. Brandenburg, V. A. Maiorov, Yu. B. Golubovskii, H.-E. Wagner, J. Behnke and J. F. Behnke, Diffuse barrier discharges in nitrogen with small admixtures of oxygen: discharge mechanism and transition to the filamentary regime. J. Phys. D: Appl. Phys., 38:2187, 2005

P 21.2 Mo 16:00 Lichthof

Phonon-mediated adsorption and desorption of electrons at surfaces — •Rafael Leslie Heinisch, Franz Xaver Bronold, and Holger Fehkse — Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, 17489 Greifswald, Germany

Adsorption and desorption of charged particles on plasma boundaries are important processes, because they regulate the charge balance on the boundary and thereby also influence the properties of the bulk plasma. We present an exploratory calculation of the electronic desorption time and sticking coefficient from a kinetic rate equation for phonon-mediated physisorption at dielectric surfaces. Electrons can be temporarily bound to the surface in a polarisation-induced surface potential. Their energy relaxation at the surface is enabled by surface vibrations whose energy scale is the Debye energy. Depending on the depth of the surface potential with respect to the Debye energy, multiphonon processes can be important for physisorption. We show that the classification of the potential depth and bound state level spacing in terms of Debye energies is paramount for a scenario of sticking and desorption and present results taking one and two phonon processes into account.

P 21.3 Mo 16:00 Lichthof

Die Temperatur von Mikropartikeln in einem Niederdruckplasma — •Horst Maurer[1], Ralf Basner[2] und Holger Kersten[1] — [1]IEAP University of Kiel, Leibnizstraße 11-19, D-24098 Kiel — [2]INP Greifswald, Felix-Hausdorff-Str. 2, D-17489 Greifswald

Die Oberflächentemperatur von Substraten spielt in technischen Plasmen, in denen es um Beschichtung oder Modifizierung der Oberflächeneigenschaften geht, eine fundamentale Rolle. Diese wird durch verschiedene Energieflüsse zwischen Substrat und Plasma bestimmt, deren Zusammensetzung von den Plasmaparametern abhängt [1].

In dieser Arbeit werden mikrodisperse Leuchtstoffpartikel als Temperatursonden in einem Plasma eingesetzt. Sie erlauben die Bestimmung der Gleichgewichtstemperatur auf optischem Wege [2]. Die Partikel werden in der Randschicht des Plasmas eingefangen, die durch eine externe Strahlungsquelle angeregte Lumineszenz wird anschliessend spektroskopisch erfasst und durch einen Vergleich mit Kalibrierspektren ausgewertet.

Es werden Ergebnisse für die Partikeltemperatur unter verschiedenen Plasmabedingungen in Argon und unter Beimischung von Molekulargasen vorgestellt, und im Bezug auf die konkreten Plasmaparameter diskutiert.

[1] H. Kersten, D. Rohde, H. Steffen, H. Deutsch, R. Hippler, G. Swinkels and G. Kroesen, Appl. Phys. A 72:531-540 (2001).

[2] H. Maurer, R. Basner and H. Kersten, Rev.Sci.Instr. 79,9:093508 (2008)

P 21.4 Mo 16:00 Lichthof

W behaviour in N_2 seeded discharges in ASDEX Upgrade — •R. Neu[1], R. Dux[1], A. Janzer[1], A. Kalllenbach[1], R. McDermott[1], H.W. Müller[1], S. Potzel[1], T. Pütterich[1], M. Sertoli[1], G. van Rooij[2], and ASDEX Upgrade Team[1] — [1]MPI für Plasmaphysik, EURATOM Association, D 85748 Garching — [2]FOM-Institute for Plasma Physics Rijnhuizen, Assoc. Euratom-FOM, Trilateral Euregio Cluster, 3430 BE, Nieuwegein, NL

Radiative cooling is an important tool to lower the power loads to plasma facing components. Amongst the different species used, nitrogen has been shown to provide the best cooling effect in ASDEX Upgrade discharges, while maintaining or even improving the confinement. Depending on the background plasma density and the divertor temperature a reduction or increase of the W sputtering yield compared to the unseeded phases was observed. In discharges with very high density, divertor plasma temperatures below 5 eV can be achieved leading to a complete suppression of the W sputtering. The W influx is a necessary prerequisite for the central W concentration (c_W), nevertheless it has been shown that c_W is mainly governed by transport. Although the energy confinement increases often in N_2 seeded discharges no strong increase in c_W is observed and there are no signs of central density peaking and W accumulation. Moreover the sustained regular ELM activity prevents a strong inward transport of W across the pedestal region.