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Electron kinetics at the plasma-solid interface

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The most fundamental manifestation of the interaction of a plasma with a solid surface is the formation of an electric double layer consisting of an electron-depleted region on the plasma side of the interface and an electron-rich region on the solid side. It arises because electrons, outrunning the heavy species of the plasma, are deposited more efficiently onto or inside the solid than they are extracted from it by the neutralization of ions and Auger de-excitation of radicals. In my talk I will present the main results of our continuing effort, recently summarized in [1], to understand the electron kinetics across the plasma-solid interface from a microscopic point of view. Motivated by the prospects of solid-based opto-electronic plasma-devices and the charging of grains in dusty plasmas we set up schemes, based–respectively–on an invariant embedding approach and a semi-empirical Anderson-Newns model, for calculating electron sticking/backscattering and secondary electron emission probabilities. Besides presenting new results for these quantities, I will describe in this talk also first steps towards a kinetic modeling of the electron kinetics at the plasma-solid interface which treats electron transport across the interface self-consistently with the charge dynamics inside the plasma and the solid. We expect this type of integral modeling to open up new vistas for controlling miniaturized discharges on semiconducting substrates [2]. For the diagnostics of the solid-based space-charge regions in these devices, finally, we propose IR-ATR and EELS spectroscopy. [1] F.X. Bronold et al., Eur. Phys. J. D (2018) 72:88. [2] J.G. Eden et al., IEEE Trans. Plasma Sci. **41**, 661 (2013). Support from the Deutsche Forschungsgemeinschaft through project B10 of the SFB/TRR24 is greatly acknowledged.