IAP Seminar

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TU Wien, Institut für Angewandte Physik, E134
1040 Wien, Wiedner Hauptstraße 8-10
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Emission of low energy electrons from solid surfaces studied by means of spectroscopy with individual as well as correlated electrons

The work is focused on studying the secondary electron emission processes in solids with the help of several methods, based on single and double electron spectroscopy. Conventional methods, such as reflection electron energy loss spectroscopy (REELS), time-of-flight spectroscopy (TOF) is used in combination with secondary electron-electron energy loss spectroscopy and, presented for the first time, inelastic very low energy electron diffraction (IVLEED) methods. The detailed description of the whole experimental setup is given together with the measurement procedure and the explanation of the employed data evaluation. A method to retrieve a full set of electronic structure parameters that are needed to study electron emission - band gap, electron affinity, inner potential, optical constants, inelastic mean free path, is presented and is shown to work well for amorphous SiO2. The inner potential of a layered electron gas material - highly oriented pyrolytic graphite (HOPG) is measured in Bragg reflection in two different geometries and shows significant discrepancies, indicating that Snell's law for electrons should be revised in the case of ordered materials. A simple secondary electron emission model is presented, based on which a Monte Carlo calculation is performed. The results show a good qualitative agreement with the SE2ELCS measurements on HOPG. The SE2ELCS measurements experimentally show the emission of secondary electrons through successive Markov-type single plasmon excitation. In the case of HOPG, the measurements are performed in Bragg reflection, allowing one to observe the full development of electron emission and are compared with the measurements on glassy carbon, allowing to study how structure affects the results. The IVLEED measurements provide a novel way of looking at the way losses occur through plasmon excitation in HOPG and eventually lead to emission of secondary electrons mainly through the interlayer state. The shape, positions and the onsets of the pi and pi+sigma plasmons are clearly seen to correlate to the fulfillment with the Bragg condition and show that the wave-function of the impinging electron is strongly damped in the solid for energies in the bandgap of HOPG.

All interested colleagues are welcome to this seminar lecture (45 min. presentation followed by discussion).

Friedrich Aumayr
(LVA-Leiter)

Wolfgang Werner
(Seminar Chair)