# Secondary electron emission from surfaces at very low impact energies

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Secondary electron emission form plasma-confining solids is an important surface process in technological low-temperature plasmas. It affects, for instance, the operation modii of dielectric barrier discharges, Hall thrusters, and divertor plasmas in fusion devices. Little is however known quantitatively about it, because it is hard to analyze experimentally while the plasma is burning. In addition, since the impact energies are typically well below 50 eV, its theoretical description is also challenging. The latter even holds for chemically clean samples. We developed a calculational approach (see Fig. 1) for secondary electron emission from chemically clean surfaces at low impact energies. Using a generalized Jellium-type surface model together with an invariant embedding approach in the quasi-isotropic approximation to solve the transport problem associated with electron emission, measured and calculated yields agree fairly well for a number of metal surfaces [1]. Our results suggest that in order to get secondary electrons out of metals, the large energy loss due to inelastic electron-electron scattering has to be compensated by incoherent elastic electron-ion core scattering, irrespective of the crystallinity of the sample. Encouraged by the rather good results for metals, we recently implemented the approach also for semiconductors, but now without the quasi-isotropic approximation, along the lines [2] developed in neutron transport theory. Preliminary results for Si are again rather promising suggesting that our approach may be flexible enough to build-up a database for emission yields at low impact energies. – Supported by DFG through Project No. 495729137.

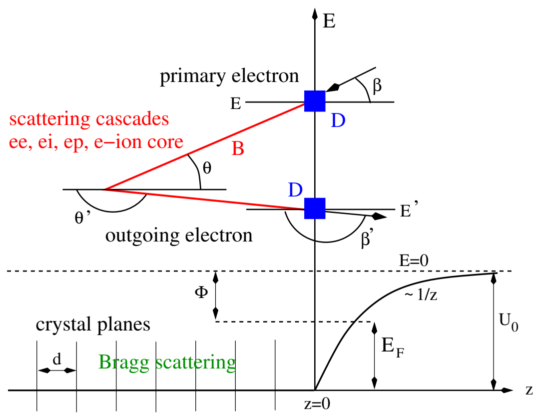


Figure 1: *Model for a metal surface to be used for the calculation of the electron emission yield at low impact energies. The backscattering function B, summing up all backwards directed trajectories due to the interaction of the primary electron with the excitations and imperfections of the solid, is the central object of our approach. It is obtained from an invariant embedding principle. Details to be found in [1].*

## References

[1] F. X. Bronold and H. Feshke, J. Appl. Phys. **131**, 113302 (2022)

[2] A. Shimizu and H. Mizuta, J. Nucl. Science and Technol. **3**, 57 (1966)