

Total Reflection High-Energy Positron Diffractometer at NEPOMUC

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Total Reflection High-Energy Positron Diffraction (TRHEPD) has been established as an ideal technique to determine the crystalline structure of topmost and immediate subsurface atomic layers. In contrast to Reflection High-Energy Electron Diffraction (RHEED), TRHEPD features an outstanding surface sensitivity, which stems from the repulsive crystal potential for positrons and the phenomenon of total reflection.

We have developed a new positron diffractometer that is coupled to the high-intensity positron source NEPOMUC at the FRM II. The setup features UHV down to 10⁻¹⁰ mbar, sample temperatures up to 1000°C and a RHEED system for complementary measurements. The positron beam is accelerated and focused by an electrostatic lens system. A transmission-type remoderator foil can be used to enhance the brightness of the beam optionally. We simulated the particle trajectories to optimize the beam properties in order to obtain a parallel, slightly converging beam with a small diameter of around 1mm (with remoderation). First experimental results are expected in spring 2019. Beside the identification of surface structures, the diffractometer will also enable us to investigate surface related phenomena such as phase transitions, reconstruction or surface melting. The project has been supported by the BMBF (funding number 05K16W07).

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