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RHEED measurements on Sapphire Al2O3

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Within the scope of this thesis, we modified and tested the new experimental set up for measuring Total Reflection High-Energy Positron Diffraction (TRHEPD [1]) and Reflection High-Energy Electron Diffraction (RHEED). The remoderated positron beam from NEPOMUC will be used for investigation of surface reconstructions with topmost atomic layer sensitivity.
In order to benchmark the RHEED system, various measurements of RHEED on sapphire (Al2O3) with orientation (0001) were performed [2]. These first test comprised: diffraction images for 360° rotation of sample in XY plane, identify high symmetry directions (0° and 30°), diffraction images with different incident angles on the same position of sample. Change in diffraction images after heating sample to 1000 ℃ was observed. Diffraction spots for high symmetry directions were compared with theory and labeled [3].
For measurements with different incident angles, magnetic deflection coils in Helmholtz-like geometry have been designed. In sample preparation several possibilities of connection between sample and sample carrier were tested and obtained respected diffraction images: ceramic glue, conductive silver paste, clamps connection, molten and solidified silver.
1) Fukaya Y., Kawasuso A., Ichimiya A., Hyodo T. 2018: Total-reflection high-energy positron diffraction (TRHEPD) for structure determination of the topmost and immediate sub-surface atomic layers, J. Appl. Phys. 52 013002.
2) V. Oderno and C. Dufour and K. Dumesnil and A. Mougin and Ph. Mangin and G. Marchal: Hexagonal surface structure during the first stages of niobium growth on sapphire (1120), Philosophical Magazine Letters, v. 58, 1998, pp 419-426.
3) Williams, David B., Carter, C. Barry 2009: Transmission electron microscopy a textbook for material science, pp 283-303.

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