

Helium Ion Microscopy of atomic steps and surface reconstruction

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Helium Ion Microscopy (HIM) [1] is well known for its exceptional imaging and nanofabrication capabilities. HIM has an unprecedented surface sensitivity, and channeling can be utilized to maximise the signal to noise ratio. We demonstrate the resolving power of the technique using a thin (2 ML) silver layer on Pt(111). The obtained HIM results are compared to results obtained by low energy electron microscopy, spot profile analysis low energy electron diffraction (SPA-LEED), and atomic force microscopy phase contrast. In HIM single atom layer high steps can be visualized as a result of a work function change—across the otherwise atomically flat terraces—of only ≈ 20 meV. By utilizing the dechanneling contrast mechanism [2] also the surface reconstruction of this thin surface layer can be revealed. We find a threefold periodic structure of channeling (fcc stacking) and dechanneling (hcp stacking) areas. The periodicity—measured along the $\langle \bar{1}\bar{1}2 \rangle$ surface direction—of this structure is 5.8 nm. This is in excellent agreement with values obtained by SPA-LEED [3].

[1] Gregor Hlawacek, Vasilisa Veligura, Raoul van Gastel, and Bene Poelsema, *J. Vac. Sci. Technol. B* **32**, 020801 (2014).

[2] Gregor Hlawacek, Vasilisa Veligura, Stefan Lorbek, Tijs F. Mocking, Antony George, Raoul van Gastel, Harold J. W. Zandvliet, and Bene Poelsema, *Beilstein J. Nanotechnol.* **3**, 507 (2012).

[3] Maciej Jankowski, Herbert Wormeester, Harold J. W. Zandvliet, and Bene Poelsema, *Phys. Rev. B* **89**, 235402 (2014).