ENGINEERING ELECTRON BANDS IN DISLOCATION NETWORKS

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Dislocation networks are frequently observed during the heteroepitaxy of materials with different lattice constant. They appear as a way of relaxing close-packed surface layers around energetically-unfavourable on-top positions. Surface dislocation networks become attractive as self-assembled lateral nanostructures with a periodic modulation of the surface potential in the nanometre scale. In particular, in noble metal surfaces and overlayers, which possess free-electron-like surface states that may scatter at the network potential. In fact, electron scattering and superlattice bands have been already probed in herring-bone like patterns in stepped Au(111) [l] and Ag monolayers on Cu(111) [2]. Noble metals are also attractive since Fermi wavelengths (λ_F) and network periodicities (p) have the same dimensions, and hence electronic/structural instabilities may arise around "nesting" ($\lambda_F = 2\times p$). In order to study this issue, we explore the ability of further tuning surface bands at noble metal dislocation networks. This can be done by forcing electron bands, e.g. by external doping, or by smoothly varying the lattice constant.

Angular Photoemission experiments have been performed at beam line 7 at the SLS synchrotron in Berkeley and at PGM beam line at the SRC synchrotron in Stoughton (Wisconsin). Both are equipped with high energy and angular resolution, display-type Scienta analyzers. In Ag/Cu(111) we track the surface band transformation from the Moiré pattern at low temperature to the triangular dislocation network at 300 K. The same Ag/Cu(111) system has been also doped with K, leading to a rigid band structure shift. The Au/Ni(111) system offers the possibility of smoothly tuning the superlattice constant by varying the Au coverage. In such case we find the surface state band rather complex, namely it appears split in Au-like and Ni-like features that evolve with the amount of deposited Au

References:

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