

Abstract

Scanning tunneling microscopy (STM) is a powerful tool to study the interplay between structural, electronic and magnetic properties with high spatial and energy resolution. In this thesis iron (Fe) nanostructures on tungsten (W) single crystals are investigated.

A systematic study of the well-known helical magnetic structure of Fe double-layer stripes on W(110) proves that domain walls always run approximately along the $[1\bar{1}0]$ direction regardless of the orientation of the substrate miscut. The magnetic structure of the double-layer of Fe on W(110) is unchanged by the adsorption of single oxygen atoms. In the vicinity of isolated oxygen impurities energy-dependent spatial variations of the local density of states (LDOS) are observed. They are interpreted as electron standing waves and compared to spin-resolved electronic structure calculations. The result is the assignment of the observed LDOS oscillations to scattering states involving minority-spin bands of *d*-like character. Spin-polarised (SP) measurements show that they are only observed on one particular type of magnetic domain, confirming the unique ability of SP-STM to study the spin character of electronic states together with their orbital symmetry.

The investigation of the system of Fe on W(001) shows a layer-dependent electronic structure in the low coverage regime. The domain structure in the pseudomorphic growth regime is studied and the fourfold anisotropy can be directly deduced from differential conductance maps. Quantitative analysis shows a layer-dependent magnetic easy axis which is along $\langle 110 \rangle$ for the second and third monolayer, but along $\langle 100 \rangle$ for the fourth monolayer. The capability of the STM to distinguish between up to eight different magnetic directions with spatial resolution demonstrates the efficiency of this method to study the magnetism of systems with reduced dimensions.