SPIN-POLARIZED SCANNING TUNNELLING MICROSCOPY OF ULTRATHIN FILMS

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Spin-polarized scanning tunneling microscopy (SP-STM) and spectroscopy (SP-STS) has been recently developed as a new tool for imaging of magnetization structures in low dimensional systems and nanostructures. In this work, we present results of the studies performed using low-temperature SP-STM and SP-STS. We investigated magnetic and morphological properties of ultrathin Fe nanowires deposited on a Mo(110) single crystal. The iron nanowires were prepared by step flow growth onto the Mo(110) substrate at 700 K during molecular beam epitaxy (MBE) in ultra high vacuum (UHV). Magnetic contrast is achieved using tungsten tips covered by Au/Co thin films. Due to the spin reorientation transition of Co films on Au an out-of-plane magnetic sensitivity is obtained for thin cobalt films, while for thicker Co coverages an in-plane magnetization component can be probed. We find that the monolayer (ML) thick ferromagnetic Fe nanowires reveal a magnetization perpendicular to the surface. Double layer **(**DL**)** nanowires show a perpendicular easy axis, too. Due to the dipolar coupling adjacent DL Fe nanowires are mostly antiparallely magnetized. Using a tip with the out-of-plane magnetic sensitivity we measured the widths of the magnetic domain walls in the ML and DL Fe nanowires, and for thicker Fe nanoislands. We find that the magnetic exchange length increases with the thickness of the Fe nanostructures. The reorientation of the tip sensitivity axis was confirmed by SP-STM measurements of thicker Fe/Mo(110) films. Our results confirm that reliable tips with defined magnetization direction can be prepared. This is an important precondition in this new exciting field.