Current-induced magnetization switching with a spin-polarized scanning tunneling microscope

STEFAN KRAUSE, Institute of Applied Physics, University of Hamburg, Germany

In present data storage applications magnetic nanostructures are switched by external magnetic fields. Due to their non-local character, however, cross-talk between adjacent nanomagnets may occur. An elegant method to circumvent this problem is magnetization switching by spin-polarized currents, as observed in GMR [1] as well as in TMR [2] studies. However, the layered structures of these devices do not provide any insight to the details of the spatial distribution of the switching processes. Spin-polarized scanning tunneling microscopy (SP-STM) is a well-established tool to reveal the magnetic structure of surfaces at spatial resolution down to the atomic scale. Besides, SP-STM takes advantage of a perfect TMR junction consisting of an isolating vacuum barrier separating two magnetic electrodes, which are represented by the foremost tip atom and the sample. Our experiments demonstrate that SP-STM serves as a tool to manipulate the switching behavior of uniaxial superparamagnetic nanoislands [3]. Furthermore, we show how SP-STM can be used to switch the magnetization of quasistable magnetic nanoislands at low temperature ($T = 31\,K$). Besides its scientific relevance to investigate the details of current-induced magnetization switching (CIMS), this technique opens perspectives for future data storage technologies based on SP-STM.