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

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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 ($T = 31\,\mathrm{K}$). 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.

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