In situ magnetization switching of magnetic probes applied to spin-polarized scanning tunneling microscopy

Pin-Jui Hsu, Chun-I Lu, Szu-Wei Chen, Wang-Jung Hsueh, Yu-Hsun Chu, Chuang-Han Hsu, Christopher John Butler, and Minn-Tsong Lin

1 Department of Physics, National Taiwan University, Taipei 10617, Taiwan
2 Institute of Atomic and Molecular Sciences, Academia Sinica, Taipei 10617, Taiwan
* E-mail: mtlin@phys.ntu.edu.tw

Soft magnetic tip was utilized to be the probe of spin-polarized scanning tunneling microscopy. It was demonstrated that the spin contrast can be reversed by in situ switching tip magnetization through varying tip-substrate distance for resolving perpendicular magnetic domain images. With this in situ magnetization direction switching of the soft magnetic tip, it is conceivable to separate magnetic from chemical and topographic contributions without applying external magnetic field. This provides an effective tool for the study of complex magnetic spin structures with various nonmagnetic impurities or compositions involved.

(a) Spin polarized conductance mapping image of 0.66 ML bilayer high Co nanoislands and the black spots on the surface of Co nanoislands are segregated Cu atoms. The corresponding topography is shown in the inset. (b) Reversed spin contrast image taken after the magnetization switching of front tip end. (c) Similar spin contrast image to the (a) taken after tip magnetization reverse again. (d) Tunneling spectra of a set of two Co nanoislands taken before and after magnetization switchings of tip end. (image sizes are all 85 x 85 nm², taken at U = -0.3 V and I = +1.0 nA).

~ This work has been published in Applied Physics Letters 96, 142515 (2010). ~