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Spin Polarized Imaging with Scanning Field Emission Microscopy

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In a *Scanning Tunneling Microscope* (*STM*) retracting the tip from the sample by 5 to 100 *nm* and applying a suitable junction bias (-10 to -100 *V* tip bias) between them bring the tip-sample junction out of the tunnelling regime and the tip becomes a source of electrons due to field emission [1]. In this regime the electrons arriving from the tip to the sample cause the generation of secondary electrons on the sample surface, which can escape from the tip-sample junction. Such electrons may be collected by several means and analysed.
This technique is named as *Field Emission Scanning Probe Microscopy* [2]. The strong dependence of the physical properties of the secondary electrons on the nature of the sample surface makes complementary information accessible. Besides the emitted and absorbed current maps and the z-piezo displacement images of the surface, chemical and magnetic contrast with nanometer scale resolution can be achieved on the same region. We are currently aiming at detecting the spin polarization of the secondary electrons, for the purpose of magnetic imaging with nanometer resolution [3].

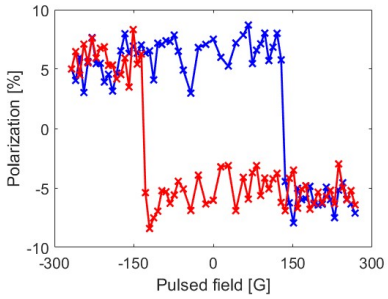

Figure 1. Hysteresis curve of secondary electrons polarization signal on 8 *ML* of Fe on W(110). Red and blue discern falling and raising field during the loop.

In this poster we present the magnetic hysteresis behavior observed on one in plane component of the polarization of secondary electrons escaped from a ferromagnetic thin film by *Scanning Field Emission Microscopy* (Fig. 1).

References

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Furthermore we show the first result of spin polarized imaging of a 500*nm* x 500*nm* region previously scanned in *STM* regime (Fig. 2) despite the fact we had a polarization signal of only 5% on the secondary electrons collected.

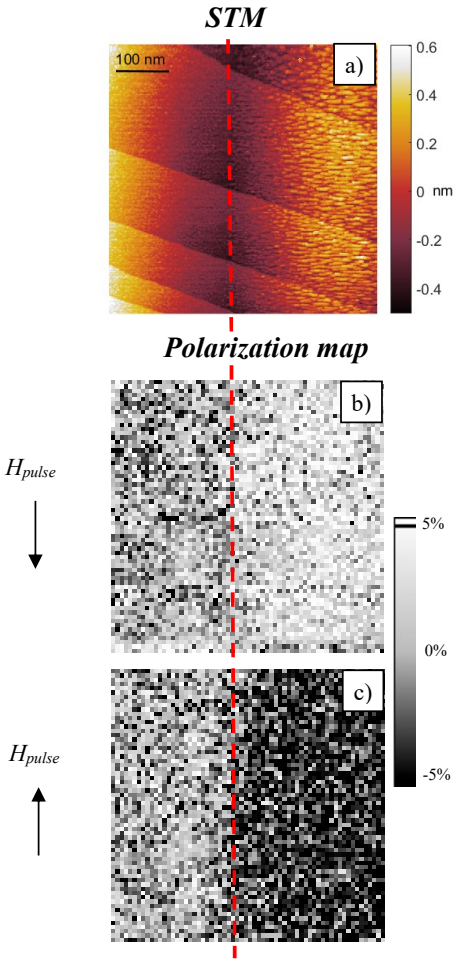

Figure 2. a) STM topografic image of 8 *ML* of Fe on W(110) as a wedge. The dash line separates the two regions, Fe on the right and W on the left. b) Secondary electrons polarization mapping of the same region after application of a magnetic pulse in the down direction. Fe appears white. c) Secondary electrons polarization mapping of the same region after application of a magnetic pulse on the up direction. Fe appears black. In both cases W is grey.

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