Electronic transport and magnetic properties in bidimensional ferromagnet $GdAu_2$ with atomic scale resolution

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2D materials display multiple physical properties that can be implemented in emerging applications, among them magnetic ordering, superconductivity or non-trivial electronic states. The $GdAu_2$ monolayer is known to be in-plane ferromagnetically ordered at low temperatures [1]. We have prepared $GdAu_2$ on a Au(111) crystal. It exhibits occasional structural antiphase boundaries (APB) that are atomically sharp linear defects separating structurally identical domains whose lattices are phase shifted. Our Spin-Polarized Scanning Tunnel Microscope (SP-STM) measurements unveil a strong tendency to antiferromagnetic coupling among two adjacent domains, as suggested by our large range surveys and hysteresis loops of the relative domain contrast. In this work, we measure the electrical resistance across an antiphase boundary (APB) of the $GdAu_2$ surface alloy with the tungsten tip of a STM.

The measurements were performed by means of the recently developed Molecular Nanoprobe (MONA) technique [2]. In this technique charge carriers (electrons or holes) are injected from the tip of a STM and detected by conformational switching processes excited inelastically by hot electrons reaching dehydrogenated phthalocyanine molecules. By statistically analyzing thousands of injection sequences the charge transport between two surface spots can be evaluated [3].

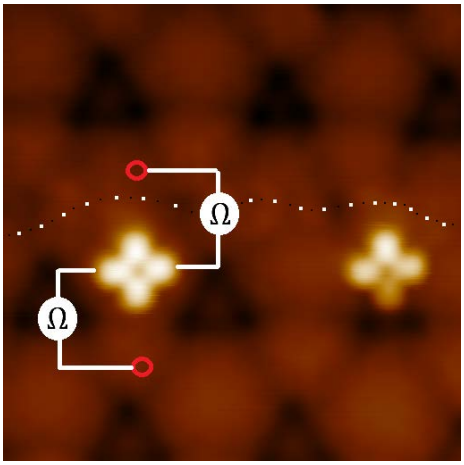

Figure 1 – STM image before start MONA technique. Surface Conductors has been measured between the molecule and the two red dots.

References

[1] M. Bazarnik et al., Atomically resolved magnetic structure of a Gd-Au surface alloy, PHYSICAL REVIEW B, 99, 174419 (2019).

[2] M. Leisegang et al., Analyzing the Wave Nature of Hot Electrons with a Molecular Nanoprobe, Nano Letters (2018),18 (3), 2165-2171.

[3] J. Kügel et al., Remote Single-Molecule Switching: Identification and Nanoengineering of Hot Electron-Induced Tautomerization, Nano Letters (2017), 17, 5106-5112.