

Masters 2 Experimental Research Internship

Condensed matter and nanophysics

Academic Year 2016/2017

Laboratory : Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS)

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Exchange bias induced by molecules

Description :

During the internship you will gain experience over the fabrication of hybrid organic/inorganic heterostructures and their magnetic characterization.

Your activities :

-fabrication of hybrid organic/inorganic heterostructures by evaporation under ultra-high vacuum. For the materials, we will consider mainly cobalt and phthalocyanine molecules.

-characterization of the structures' morphology by scanning probe microscopy, x-ray reflectivity.

-characterisation of the structures' magnetic properties by SQUID and/or magneto-optical Kerr effect.

-analyze the results in terms of exchange bias.

General context :

The aim of this work is to advance the knowledge necessary to build organic spin based memories or sensors. In particular, it is very appealing to gain more insight into the physical aspect of exchange bias between a magnetic metal and molecules. This effect was discovered recently by two groups, including our team (fig. 1) [GRU15, RAM13].

Exchange bias was of main importance in the improvement of inorganic spintronics so that it is nowadays widely used in devices. It is thus wise to put some effort in developing exchange bias with organic materials, if possible to a level where it could be used in commercial devices. Regarding this aspect, the main issues are i) to push the blocking temperature above room temperature then ii) get a significant bias field with iii) no training effect.

Bibliography :

[GRU15] M. Gruber et al. Nature Mater. **14** 981 (2015).

[RAM13] K. V. Raman et al. Nature **493** (2013) 509.

Figure 1 : Hysteresis loop of a Co(20 ML)/MnPc(25 ML) bilayer capped with 20ML Au. The shift of the loops toward negative field values as the temperature goes from 300 K to 14 K is called exchange bias [GRUB15].

