ESRF	**Experiment title:** Magnetism of 3d metal atoms absorbed on graphene: correlation with electronic properties	**Experiment number**: HE 3424
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Report:

We report on experiments using XMCD and XMLD at the beamline ID08. The aim of the experiments was to study the properties of the magnetic impurities Co, Fe and Ni on monolayer graphene (MLg) prepared on two different substrates: Ru(0001) and SiC(0001). In particular, we wanted to investigate if graphene modifies the magnetic and electronic properties of adsorbed atoms and confirm the nonmagnetic ground state of Ni adatoms deposited on graphene.

All samples were prepared in the ID08 preparation chamber and measured with a scanning tunneling microscope (STM) at room temperature. We successfully prepared MLg on Ru(0001) single crystal by means of cracking ethylene and we achieved clean graphene on SiC(0001). In particular, we obtained moiré pattern resolution with the STM and we were able to prove the quality of the graphene prepared on Ru surface and on SiC(0001) substrate, see Fig. 1a and b. Measurements were performed with and without magnetic field, at angles of 0^o and 70^o between the samples normal axis and the magnetic field axis and temperatures between 10K and 300K. The impurities were deposited on the cold sample at 10K before the XAS spectra were taken.

We select in the following four samples as a summary to show that we could address the points mentioned above. Firstly, we concentrated on the single Ni atoms on graphene using XAS spectroscopy. As it was expected in the theoretical calculations the XMCD signal vanishes for individual single Ni atoms on the MLg/Ru(0001) system [1,2]. Interestingly, for the Ni single atoms deposited on MLg prepared on SiC(0001) the XMCD signal is weak but visible and a more detailed analysis is under progress to understand this different observation (cf. Fig.2a and b).

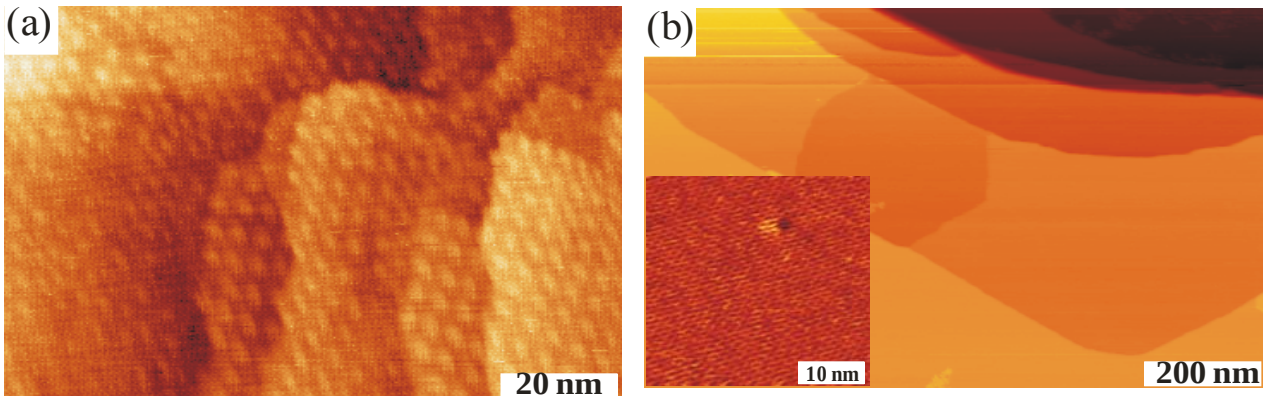

Fig. 1. (a) and (b) STM topography of MLg on Ru(0001) with visible moiré pattern and on SiC(0001) surface, respectively. The inset in (b) presents the moiré pattern of monolayer graphene on SiC(0001).

Additionally, Figure 2c and d display the XAS spectra taken at the $L_{2,3}$-edges recorded for Fe, and Co impurities deposited on graphene on SiC(0001) for left and right polarized light. The XMCD spectra are also shown for each case. The XMCD signals are small and a more detailed analysis is under progress, also taking into account measurements on different samples. Magnetization loops (not shown) measured for magnetic impurities indicate that magnetization is not saturated at 5T.

Further analysis and theoretical calculations will be done in the next months to better understand the data obtained with circular and linear polarized light.

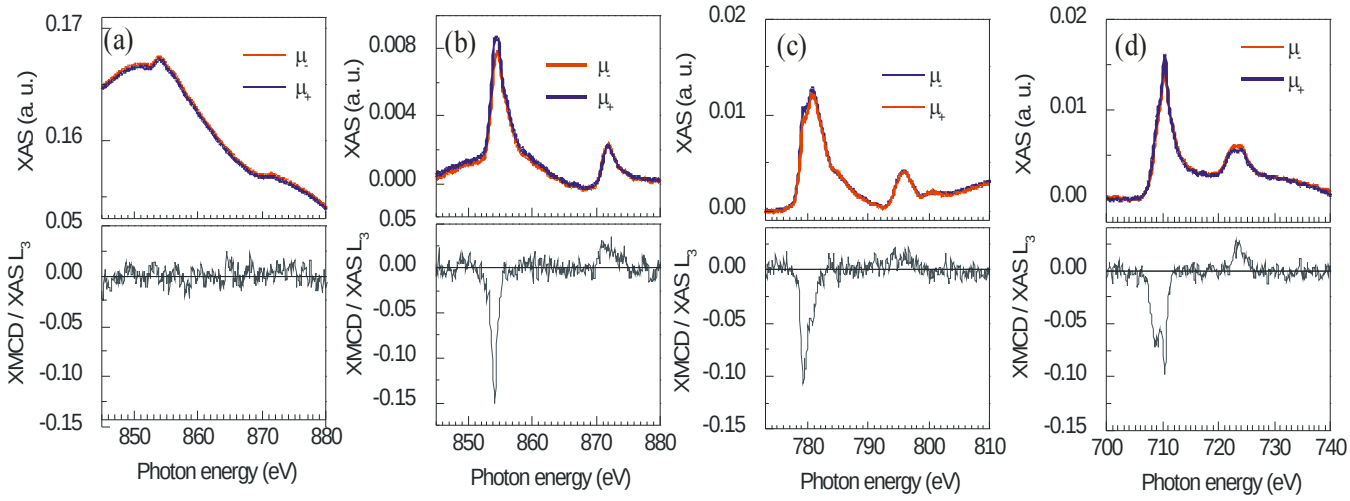

Fig. 2. XAS spectra taken at (a) 0.01 monolayer equivalent (MLE) Ni/MLg/Ru(0001), (b) 0.006 MLE Ni/MLg/SiC(0001), (c) 0.005 MLE Co/MLg/SiC(0001), (d) 0.01 MLE Fe/MLg/SiC(0001) $L_{2,3}$ edges at T = 10 K and $\mu 0H$ = 5 T with right and left circularly polarized light at $\theta = 0^{\circ}$ and resulting XMCD spectra. The background was subtracted for (b-d).

References:

[1] M. Hentschel et. al, *Phys. Rev. B* **76** (2007) 115407
[2] C. Cao et. al *Phys. Rev. B* **81** (2010) 205424