ESRF	**Experiment title:** Local structure probed in 3D nanostructured MPt_3 thin films by XAFS	**Experiment number**: 30 02 842
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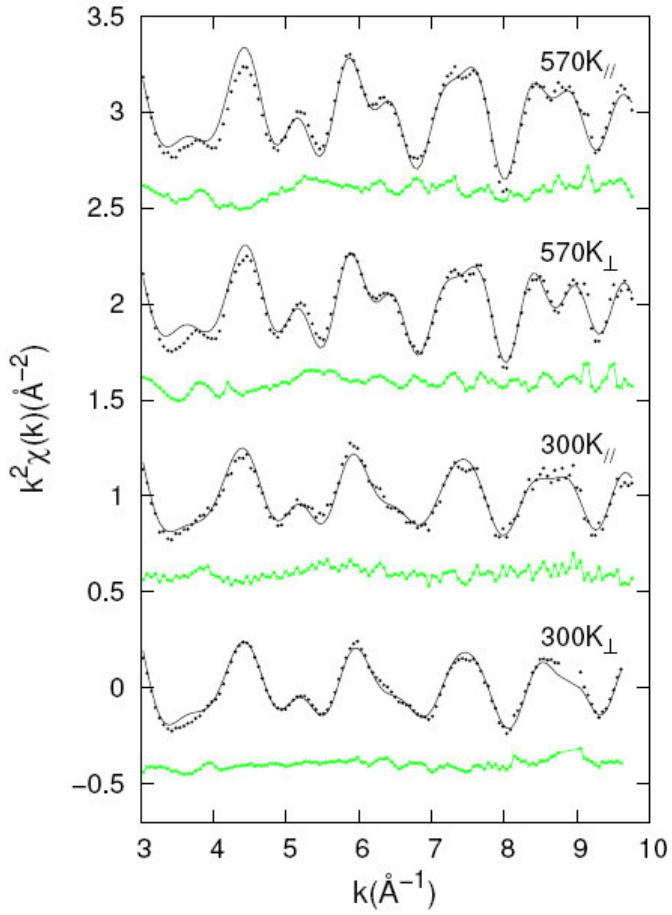
Report:

The XAFS spectra were collected on the FAME-BM30B beamline, at 14K, at the Co-K edge and in fluorescence mode using a 30-element Canberra Ge solid state detector. 3nm-thick deposits of $CoPt_3$ alloy were measured under two incidence angles (10 and 80 deg corresponding to out-of-plane polarization and in-plane polarization respectively) for sorting the neighbours located out of the plane containing the absorbing atom from the ones in this plane. The samples were prepared by co-deposition of Co and Pt atoms under UHV at the University of Konstanz. 4 samples were prepared on the van der Waals surface $WSe_2(0001)$ and two samples on NaCl(001) leading to dense assemblies of epitaxial nanostructures grown along the [111] and [001] directions respectively. The lateral sizes of the nanostructures are ranging between 5 and 15nm and their heights between 5 and 8nm dependent on the growth temperature and substrates. From X-ray diffraction measurements the Co atomic composition of the prepared alloys is found equal to 80 at%, still in the composition range of the $L1_2$ phase. The sample grown at 300K on WSe_2 presents no long-range $L1_2$-type ordering but a magnetic perpendicular anisotropy(PMA), while the three samples grown at higher temperatures 370, 570 and 700K have $L1_2$ ordering but no PMA. The samples grown on NaCl(001) present neither long-range ordering, nor PMA and were studied essentially for comparison. All the substrates were maintained on STM holders allowing their transfert from the preparation chamber into a portable vacuum chamber (10^{-8}mbar) which was carried on the BM08 beamline. The samples were shortly under air exposure before introduction in the cryostat. They were fixed on a Cu sample holder screwed

at the end of the cryostat rod. The samples were vertical in the cryostat and the beamsize was 300(H)x150(V)μm^2.
The XAFS spectra were analyzed using the amplitude and phase shift functions calculated by the FEFF code in both disordered fcc and $L1_2$ structures.
The figure shows the best fits (continuous line) of the experimental spectra (points) for the two samples grown at 300 and 700K on WSe_2 measured for in-plane (//) and out-of-plane polarization ($\perp$). They were obtained taking into account the neighbors up to the fourth coordination shell.



The extracted parameters for the sample grown at 300K reveal an anisotropic chemical short-range order (CSRO) restricted to the first shell such as the CoCo bonds are preferentially in the film plane. Such atomic arrangements would produce some interface anisotropy which would be at the origin of the PMA. In contrast for the sample grown at 570K such anisotropy vanishes in agreement with the absence of PMA.
For the samples grown on NaCl(001), the simulations of the experimental spectra were done by taking into account the neighbors up to the fifth shell. For the two studied samples, CSRO is perfectly isotropic and already well pronounced in the deposit at 370K, while in the two samples no $L1_2$ order was observed by RHEED.
The different behaviours of deposits on WSe_2 and NaCl can be explained either by the different growth directions, or by the Se surfactant effect which coupled with Pt surface segregation would promote the anisotropic CSRO.