Preparation of thin films of uranium and UH_3, and their magnetic properties

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UH_3 was the first actinide compound ever observed to be a ferromagnet [1]. We have grown thin uranium films of different thicknesses using a sputter technique, followed by a cap layer, and characterised the films via *in-situ* XPS. The cap layer of Pd serves to achieve hydrogenation and to avoid oxydation. In Fig. 1 one can see the evolution of Pd peaks at the expense of the uranium peaks, although the U signature does not vanish until the end. Such a behaviour is consistent with the U-Pd phase diagram.

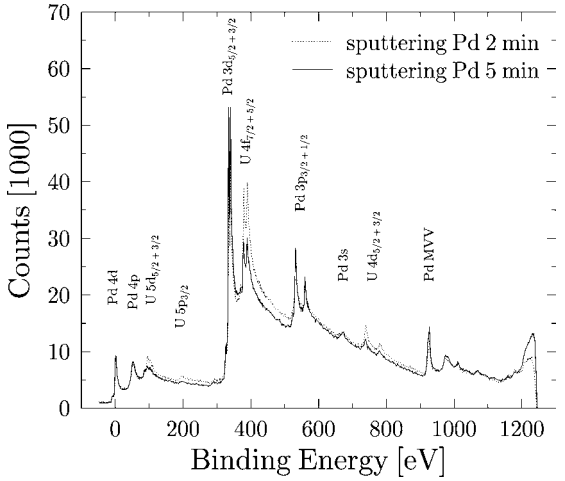

Fig. 1. XPS spectrum for the growth of a Pd capping layer onto a uranium film.

Before and after hydrogenation, one can easily study the magnetic properties of the films using SQUID magnetometry. Like in the bulk material, UH_3 films show ferromagnetic behaviour below about 180 K, as shown in Fig. 2. Albeit a rather inhomogeneous look of the films after hydrogenation, the value of the saturation magnetisation, compared with bulk figures [2] suggests that the whole sample has been switched to the state UH_3. On the other hand, one observes a strong increase of the coercivity of the films.

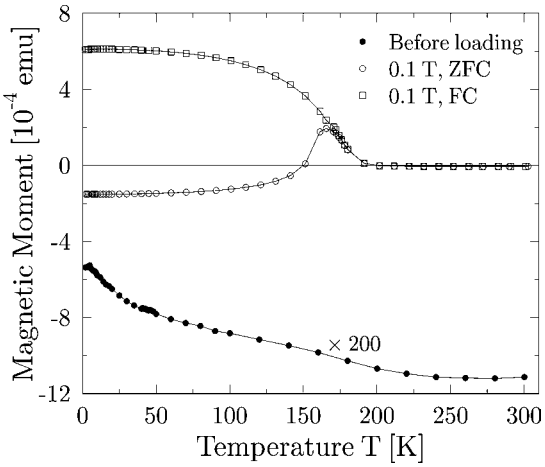

Fig. 2. Magnetisation as a function of temperature before (lower part, multiplied by 200) and after H-loading (upper part) for 1 hour under 1 bar atmosphere.

In this contribution we will demonstrate the growth of thin uranium films, the hydrogenation process, and the resulting magnetic properties of UH_3.

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References

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