METAL HYDRIDES IN MAGNETISM

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The use of hydrogen absorption to tune the magnetic properties of alloys and compounds has a long and prosperous history. From the use of hydrogen processing of high performance permanent magnets [1] to tuning the Curie temperature of magnetocaloric materials [2], hydrogen absorption has been important in the development of the modern magnetic material.

The magnetic properties of a material are given by the electronic structure. The interaction between unpaired electrons in different ways can yield different magnetic behaviour from the simple ferromagnets to more complex interaction like magnetic frustration and spin ice. Hydrogen incorporation in magnetic materials provides a unique possibility to probe the electronic structure and provide insight into the interplay between chemical bonding and magnetic properties. In particular, itinerant electrons may be localized as H^- through the formation of interstitial hydrides. This generally leads to a change of the strength and possibly also the sign of the magnetic interaction.

During this lecture, I will give a general introduction to magnetism in general as well as the field of metal hydrides in magnetism, followed by a discussion of some recent results from my group [3] and others. The talk will finish with some perspectives, challenges and the future prospects of this research field.

References

1. Harris, I.R. and P.J. McGuiness, *Hydrogen: its use in the processing of neodymium-iron-boron-type magnets.* J Less-Common Met, 1991. **174**(1-2): p. 1273-1284.
2. Fukamichi, K., A. Fujita, and S. Fujieda, *Large magnetocaloric effects and thermal transport properties of La(FeSi)13 and their hydrides.* Journal of Alloys and Compounds, 2006. **408–412**: p. 307-312.
3. Ångström, J., et al., *Hydrogenation-Induced Structure and Property Changes in the Rare-Earth Metal Gallide NdGa: Evolution of a [GaH]2– Polyanion Containing Peierls-like Ga–H Chains.* Inorganic Chemistry, 2016. **55**(1): p. 345-352.

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My research is generally focused on the synthesis and characterisation of novel bulk materials for energy storage and conversion, which I study in particular with different diffraction techniques, but also including absorption/desorption measurements and electrochemical methods. Main applications are in the hydrogen storage and battery areas well as magnetic materials.