MATERIALS

HYDROGEN

NEUTRONS FOR SCIENCE

Composite compounds for Hydrogen storage

METAL HYDRIDES ARE POTENTIAL HYDROGEN CARRIERS, THANKS TO THEIR RELATIVE STABILITY, AND ABILITY TO TAKE UP AND THEN RELEASE LARGE AMOUNTS OF THE GAS.

THE PROBLEM TO SOLVE:

Unfortunately, the high stability of many complex hydrides means that the temperatures at which they decompose are too high (typically about 600°C).

A STEP TOWARDS THE SOLUTION

Neutrons are very sensitive to light elements (Hydrogen, Lithium) and several experiments using neutrons have shed light on the decomposition (dehydrogenation) pathways for composite systems containing lithium. Changes in crystal structures and composition during these reactions progress were investigated with neutron diffraction.

An example of the importance of in-situ exploration of dehydrogenation path-ways of new composites is the lithium-hydride-germanium system. Adding Germanium (Ge) greatly increases the ease of dehydrogenation for lithium hydride (LiH), so that hydrogen evolves at much lower temperatures, around 270°C.

THE RESULT

It was found that the reaction pathway goes through a sequence of steps involving Ge-rich compounds (Fig. 2), with the content of lithium gradually increasing. Further measurements associated with the various compositions showed that such hydride systems could be optimised to operate at low working temperatures.

The in situ exploration of hydrogen uptake and release pathways with neutrons allows optimisation of the composition of new materials.

Fig. 1 Mg alloy as flakes for H2 storage Credit: © Fraunhofer

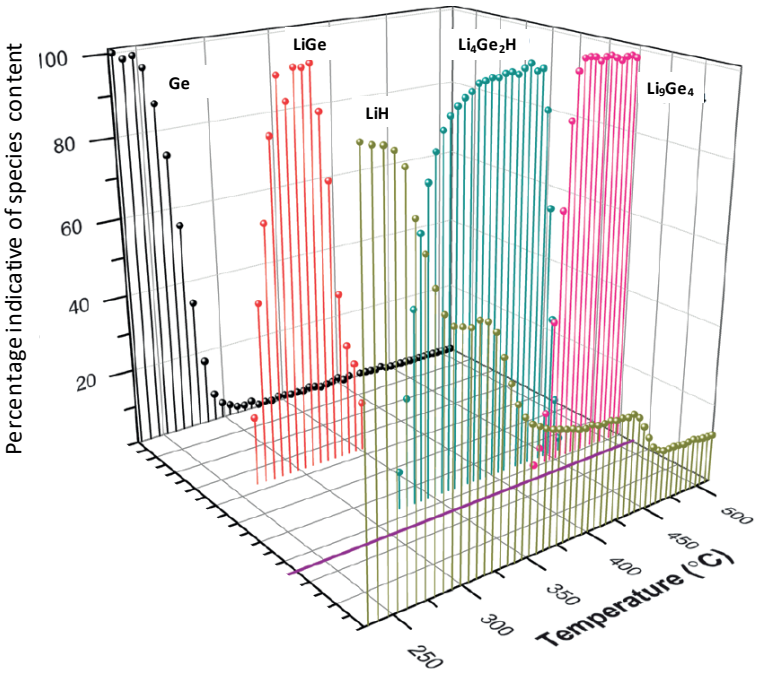

Fig. 2 Species found during the decomposition of a 3-LiH/Ge sample. Reproduced from Abbas et al. 2013, with permission from the PCCP Owner Societies.

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http://sine2020.eu/industry.html

Reference: M. Abbas, D. Grant, M. Brunelli, T. Hansen, G. Walker, Phys. Chem. Chem. Phys., 15 (2013), Neutrons and Energy ILL (2015)

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