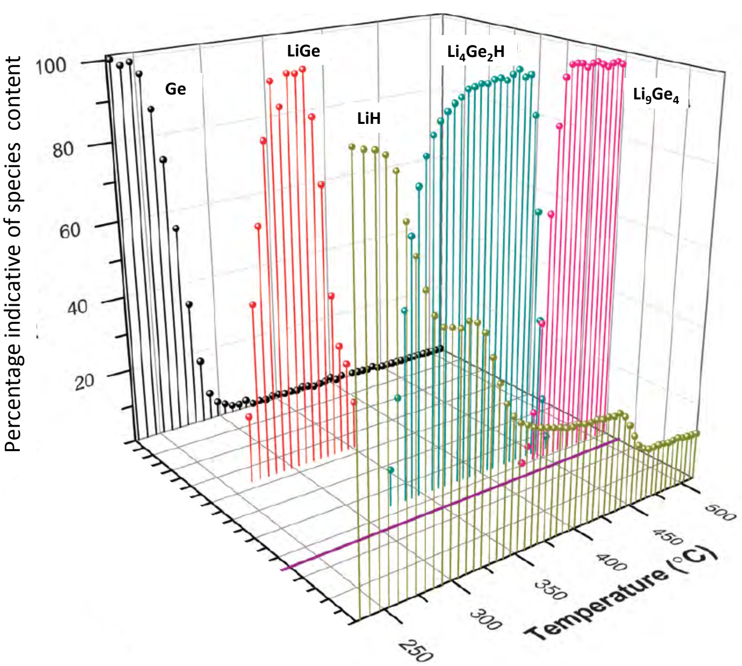
Composite compounds for Hydrogen storage

Metal hydrides are potential hydrogen carriers, thanks to their relative stability, and ability to take up and then release large amounts of the gas. Unfortunately, the high stability of many complex hydrides means that the temperatures at which they decompose are too high (typically about 600˚C).

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

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 pathways 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.

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.

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 to optimise the composition of new materials.

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

Neutrons for Industry

industry@sine2020.eu

SINE2020 Industry Consultancy is now open for requests.

Proof-of-concept experimental beam time is being offered to Industry!

RAPID ACCESS

Fast-stream processing for industrial applications, optimising result lead times.

CONFIDENTIALITY

Activity covered by non-disclosure agreements. Only company name and measurement type to be published.

FLEXIBLE SERVICES

In many cases industrial processes and conditions can be re-created in the test laboratory. Final data analysis and reporting are provided.

EXPERT CONSULTANCY

Industrial R&D professionals in collaboration with experienced specialists from European neutron centres.

PARTNERS FROM:

Czech Republic,
France,
Germany,
Hungary,
Netherlands,
United Kingdom.

SINE2020 receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 654000