



## Studies of solid state hydrogen storage materials by SAXS and QENS

Shi, Qing; Jacobsen, Hjalte Sylvest; Vegge, Tejs

*Publication date:*  
2005

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*

Shi, Q., Jacobsen, H. S., & Vegge, T. (2005). Studies of solid state hydrogen storage materials by SAXS and QENS. Abstract from 3rd Annual Meeting in the Copenhagen Graduate School for Nanoscience and Nanotechnology, Copenhagen, Denmark.

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## Studies of solid state hydrogen storage materials by SAXS and QENS

Qing Shi <sup>a, b</sup>, Hjalte S. Jacobsen <sup>a</sup>, Tejs Vegge <sup>a</sup>

<sup>a</sup> *Materials Research Department, Risø National Laboratory, DK-4000 Roskilde*

<sup>b</sup> *Copenhagen Graduate School for Nanoscience and Nanotechnology (CONT),  
University of Copenhagen, DK-2100 Copenhagen Ø*

There is an urgent need for alternative energy carriers, which is due to the limited supply of fossil fuels on the Earth. Much research focused on hydrogen is performed by scientists, governmental and non-governmental institutes, and even many companies. Hydrogen is the most abundant element on the Earth; moreover, the chemical energy per weight of hydrogen (142MJ/kg) is at least three times larger than that of other chemical fuels<sup>1</sup>. However, hydrogen storage is still a key problem remaining to be solved, due to the difficulties of compacting hydrogen. Recent studies demonstrate that metal hydrides can potentially be utilized to solve the storage problem by reversible ab- and desorption of large amounts of hydrogen.

Since Bogdanovic and Schwikardi<sup>2</sup> discovered the catalytic effect of titanium on reversible hydrogen storage in complex metal hydrides, these materials have dominated the research field due to their high theoretical hydrogen storage capacity. Nevertheless, only very little known about physical role of titanium on e.g. hydrogen rotation and diffusion processes. Scattering is a powerful technique to study the micro-phase structure and dynamics of particles with a typical size from 1 to 20,000 nanometers<sup>3</sup>. In this project we use small angle X-ray scattering (SAXS) to investigate the nano- and microstructural evolution during ab- and desorption cycles, e.g. on the metal ammine complex  $\text{Mg}(\text{NH}_3)_6\text{Cl}_2$ , and quasi elastic neutron scattering (QENS) to obtain information on the effect of  $\text{TiCl}_3$ -doping on hydrogen rotation and long-range diffusion in  $\text{NaAlH}_4$  and  $\text{Na}_3\text{AlH}_6$ .

---

<sup>1</sup> L. Schlapbach and A. Züttel, *Nature* **414**, 353 (2001).

<sup>2</sup> B. Bogdanovic and M. Schwickardi, *J. Alloys and Compounds* 253, 1 (1997).

<sup>3</sup> Lindner, P. and Zemb, Th. *Neutrons, X-rays and Light: Scattering Methods Applied to Soft Condensed Matter*, North-Holland, (2002).