Laboratorium für Nano- und Quantenengineering

Leibniz Universität Hannover

# LNQE-Kolloquium

**Mittwoch, 28.05.08 um 17:30 - 18:30 Uhr**

**im Hörsaal im LfI (Schneiderberg 32) + Get-Togehter im Foyer**

## *“Hydrogen Storage in novel complex hydrides”*


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Limited energy resources, mainly concentrated in politically unstable regions and increasing pollution associated with classical energy production have stimulated the search for cleaner, cheaper and more efficient energy technologies.

Nature found a solution for the storage of (solar) energy in a very effective way, and it is of course intriguing to have a closer look, how nature succeeded. In photosynthesis, water is split by sun light, revealing gaseous oxygen and two protons and electrons, which can recombine releasing gaseous hydrogen. This can be used to let plants (algae etc.) produce hydrogen, if one hinders the plant to use the protons and electrons for its own purpose. Usually, the plant stores the energy of the hydrogen by chemically adding the protons to organic substances, which results via a complex process in the production of carbon hydrates. Certainly, we can (and do) make use of these carbon hydrates (“biofuel”). However, the extension of biological energy conversion on a large scale is questionable due to unforeseeable ecological and social consequences.

Can we make use of Nature’s solutions for energy conversion/storage problems and transform them into engineering solutions (“bionics”)? One promising technology involves hydrogen produced by solar energy conversion, stored in metal hydrides, and eventually be used in fuel cells. However, for replacing existing technologies, still a large number of problems have to be solved, demanding for extensive fundamental research in the field of materials science.

A future hydrogen economy requires dense, safe, efficient and reversible hydrogen storage materials. Hydrogen as an energy carrier is difficult to store because of the low critical temperature of 33 K, i.e. hydrogen is a gas at room temperature. Hydrogen storage in solids offers a safe alternative to storage in compressed or liquid form. The ideal hydrogen storage material should have the following properties: high gravimetric and volumetric hydrogen density, fast kinetics of (de)hydrogenation near ambient temperature, long term stability and good thermal conductivity for removing the reaction heat. The abundance and affordable price of used materials is also of importance. However, at present, no single material fulfilling all requirements is in sight.

In my talk, I will focus on problems related to the materials science of hydrogen storage. I will discuss the standard approach for the search of hydrogen storage materials, i.e. the synthesis of bulk (powder) samples and the volumetric, gravimetric and calorimetric analysis of the hydrogen sorption in the sample. Apart from the standard approach, I will introduce novel strategies and characterisation techniques like optical spectroscopy. Materials focus will be the complex hydrides. The hydride complexes of borane, the tetra¬hydro¬borates M(BH4), and of alane the tetrahydroaluminates M(AlH4) are interesting storage materials, however, they were known to be stable and decompose only at elevated temperatures and often above the melting point of the complex.