STORHY FINAL EVENT
HYDROGEN STORAGE SYSTEMS FOR AUTOMOTIVE APPLICATION
PSA POISSY, JUNE 3-4, 2008

Solid Storage: Up-scaling & Tank Design

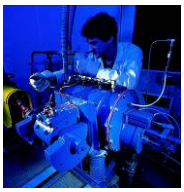
Objectives

- Large-scale production of hydrides with similar properties as obtained on lab-scale
- Lab-scale evaluation of modified alanates
- Tank design and construction for lab-scale and 1/10th scale tanks with sufficiently fast kinetics
- **Evaluation of lab-scale and 8 kg bread board tank as basis for realistic simulations of large solid storage tanks**

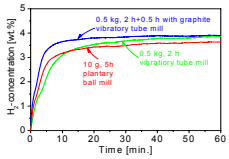
Achievements

- A cost effective, efficient production route for large amounts of hydrogen storage material (doped $NaAlH_4$) has been developed and tested.
- Up to 3 kg batches of light metal have been synthesized at GKSS.
- Up-scaling to continuous processing of tonnage quantities possible.
- The energy required for the process is calculated to be 1-5 kWh/kg at a cost << 1 €/kg.
- The material synthesized via the above mentioned procedure is equivalent or better than material produced in lab-scale.
- Heat exchange is a key factor for achieving fast kinetics. Thermal conductivity has been increased by ~ 40 % by the addition of 5 wt. % carbon. This concept will allow for further improvements, especially in combination with compaction.
- Material withstands exposure to 220 °C: temperature spikes and sintering uncritical for doped $NaAlH_4$, extremely important for fast filling.
- For the first time in the EU, a larger tank for 8 kg doped alanate was successfully designed and built.
- The design of the tank has been systematically optimized for the best possible kinetics to prove transferability of lab-scale absorption and desorption rates.
- Simulations confirm a charging time to 80 % of less than 5 minutes in agreement with StorHy targets (see fact sheet)

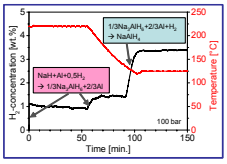
Glove box system for powder processing

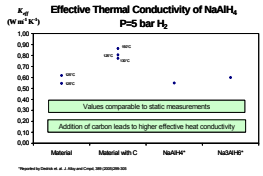


Vibratory tube mill, screening technology ESM 234



Performance of large-scale processed material





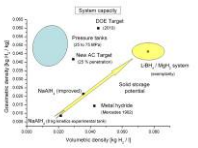
Thermal conductivity (above) for doped $NaAlH_4$. Kinetics of material exposed to sintering at 220 °C (left)

Photograph of the StorHy 8 kg alanate bread board tank. It is composed of seven modules and has a capacity of 400 g H_2. Charging: 100 bar, 125 °C; discharging: vacuum to 5 bar, 150 °C.

Future Perspectives

Further optimization potential for future projects regarding optimum mass related capacity and efficiency include:

- High-capacity materials (e.g. $LiBH_4/MgH_2$: 11.5 wt.%), reduction in the operating pressure and temperature
- Increase of the heat transfer coefficient by additives and compaction
- Light-weight hull materials with minimum required thickness
- Complementary system integration for optimized heat usage and efficiency



Potential of solid storage systems. Conditions: Materials capacity: 4 / 10 wt%; ρ: 1270 / 963 kg/m^3; Porosity: 53 / 30 %; Max. T: 300/180 °C; Heat transfer coefficient: 0.55 W/mK; Pressure: 100/50 bar

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Website	www.storhy.net

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