

High Density Hydrogen Storage System Demonstration Using NaAlH_4 Complex Compound Hydrides

D.L. Anton

Principal Research Scientist

United Technologies Research Center

411 Silver Ln., E. Hartford, CT 06084

ph: 860-610-7174

FAX: 860-610-1697

e-mail: antondl@utrc.utc.com

DoE Project Kick-Off Meeting

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Program Specifics

Objective: Develop, build, bench demonstrate and deliver a 5 kg H₂ capacity hydrogen storage system suitable for operation of a PEMFC powered mid-size auto application based on NaAlH₄ derived compounds.

Funding: \$2.45M (*20% cost share*)

Duration: 48 months

Development Partners



**NaAlH₄
Supply
?**

**NaAlH₄
Technology
?**



Research Center

Program Goals

Characteristic

Requirement

Consequence

•System

- Storage wt% 6.0wt%
- Specific Energy 7.2 MJ/kg
- Energy Density 0.045kg H₂/liter
- Capacity 5 kg H₂

•Recharge Time

< 5 min.

•Parasitic Loss

<10%

•Cycle Life

500 cycles

•Cost

\$33.79/kg H₂

•Temp Range

-30 min. start temp.

-90°C operating temp.



7.5 wt% H₂ media

67 kg media

90wt%/hr recharge rate

Transient Response Limit

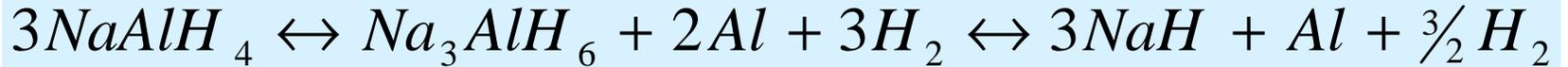
<0.02%/cycle degradation

~\$167 mfg. cost/unit

??

PEM compatible

NaAlH₄ Development



3.7wt%

1.8wt% =

5.5wt% H₂

Attributes:

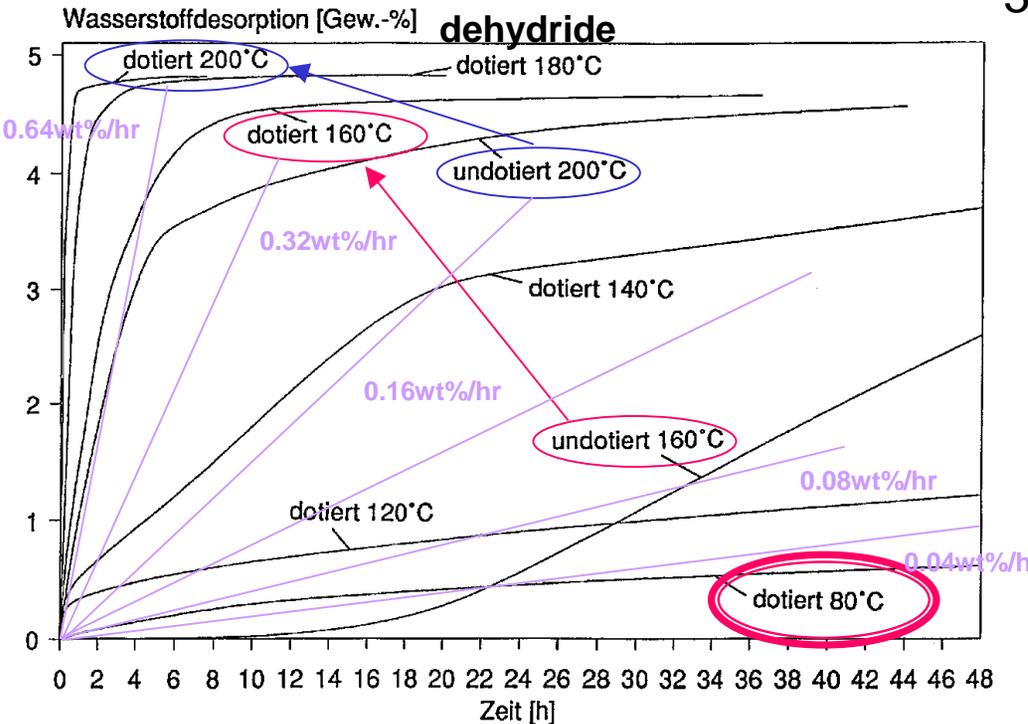
- ~4.5 wt% H₂ reversibly achieved at 160°C
- Ti⁴⁺, Ti³⁺ & Zr⁴⁺ effective catalysts

Challenges:

- Discharge rate insufficient for PEMFC vehicle at 80°C
- Theoretical 5.5 wt % not achievable
- Slow hydration kinetics at moderate temp./press.

Evaluation:

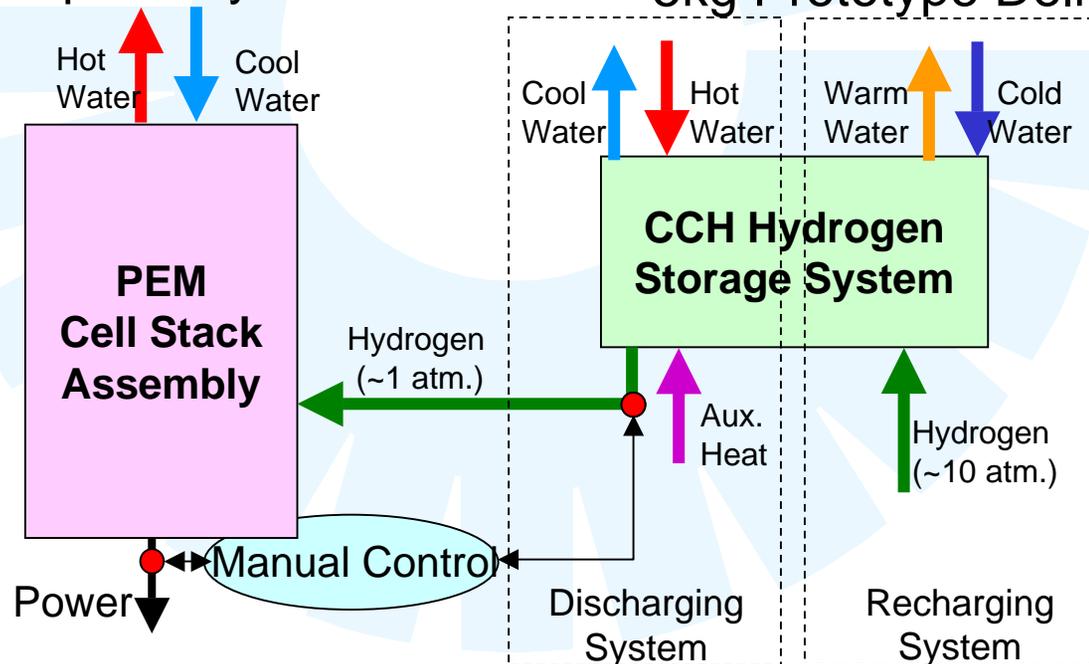
- Immature technology with good commercial prospects in 10 year time frame.



Technical Breakthrough
B. Bogdanovic, Max Plank Inst.
J. Alloys & Comp., 1997

Approach

- Safety Analysis
- Compound Development
 - *Rate*
 - *Capacity*
- 50g H₂ Prototype System
- Materials Compatibility
- Heat/Mass Transfer Analysis
- Systems Integration Analysis
- Scale Up Media Fabrication
- 1kg H₂ Prototype/Evaluation
- 5kg H₂ Prototype/Evaluation
- 5kg Prototype Delivery



Schedule

