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# Reversible on-board Storage: Metal Hydride R&D

*Rapporteur &  
Session Co-Chairs  
Andreas Zuettel, Craig Jensen, Rosario Cantelli*

## Alanates

- Pros: dehydriding kinetics and cycling behavior
- Cons: capacity less than 5%
- Quantitative results: 3.5-5.0 wt%
  - $T=100-150\text{ }^{\circ}\text{C}$
  - $\Delta H= 37\text{ kJ/mol}$
- Comment: Na alanates best studied
  - Other alanates should be explored

## Amides

- Pros: capacity and cycling behavior
- Cons: dehydriding kinetics
- Quantitative results: 5-9 wt%
- $T=170-250\text{ }^{\circ}\text{C}$
- $\Delta H(\text{Li/Mg})= 43\text{ kJ/mol}$
- Comment: mixed metal amides show promise

## Borohydrides

- Pros: capacity

- Cons: kinetics, reversibility in some cases

- Quantitative results: ~ 9 wt%

  - $T = \sim 300 \text{ }^\circ\text{C}$

  - $\Delta H(\text{LiBH}_4/\text{MgH}_2) = 45 \text{ kJ/mol}$

- Comment: mixing with binary hydrides shows  
promise

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## Applications

- High pressure metal hydride tank has been developed by Toyota
- Optical hydrogenography has been shown to have diagnostic applications for hydrogen storage
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## Highlights

- ✓ Adequate dehydriding and re-hydriding kinetics have been achieved with Na alanate
- ✓ Mixed amides found to have high capacity, reversibility, and improved kinetics
- ✓ Borohydride/binary hydride mixtures found in some cases to be reversible
- ✓ Mechanism of reversible dehydriding of doped complex hydrides found to involve high mobility, defect hydrogen complexes

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## Barriers discussed in the Session

- Reversibility
- Kinetics
- Thermal management
- Others

## Ongoing collaborations

- University of Hawaii: University of Rome “La Sapienza”, University of Milan, IFE (Norway), General Electric, Univ. Tohoku
- Nat. Univ. Singapore: Sandia NL, Inst. Appl. Energy (Japan), Wolf (Germany)
- Tohoku Univ.: Univ. Hawaii, Toyota R&D, Univ. Fribourg, Sandia N.L.
- Univ. Fribourg: Univ. Tohoku, Univ. Amsterdam, IFE, Univ. Birmingham, Univ. Hiroshima, Toyota R&D, BMW
- MPI: Opel/General Motors



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## Proposed collaborations

- University of Rome “La Sapienza” – University of Hawaii – University of Milan – AIST (Tsukuba)
- Univ. Salford – Univ. Tohoku – Univ. Fribourg