Advanced/Complex Hydrides

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Targets/Priorities

- Need 8% Hydrogen storage capacity for the material
  - Interim goal (5-year) of 6%
- Make sure we understand the fundamentals of model materials, make sure we are doing this the best we can
- In parallel, look at other materials
- Assume we just have good system design (80%)

Additional Targets

- Charging/discharging kinetics
  - < 5 min fill
  - 0.025 g/sec per kW discharge
- Safety
  - As good or better than a gasoline tank
- 1 atma at <80°C (110°C?)
- 500 cycles (80% retained capacity)

Priorities

- $NaAlH_4$
  - Build on current efforts to develop an in-depth, fundamental understanding that can be used to tune synthesis of new materials
- In parallel, need to look at other alanates (e.g. $LiAlH_4$)
- Next priority:
  - $LiBH_4$ and other Borohydrides
  - Transition metal complexes
- Long Shot
  - AlH_3

Other Areas

- Non-thermal (mechanical/chemical) discharge mechanisms
- Scaleability
  - Cost sensitivity
  - Materials synthesis
- First principle calculations
- Nanocomposites
- Hybridized systems
- Combinatorial approach to material synthesis

Milestones – Material Development

- Fundamental studies on $NaAlH_4$ complete (2005)
  - Understand how these materials work and how to apply this understanding to other materials
- Achieve 6 wt% (2007)
  - Within 3-4 years a material should be identified that has a chance of achieving 6+
- Achieve 8 wt% (2010)

Milestones – Storage System

- 40 g (H_2) bed for engineering studies (2003)
- 5 kg (H_2) full-size vehicle prototype (2006)
  - Preliminary system cost analysis completed
  - Large scale material production
- Full-size vehicle bed certified for use (2007)
  - Independent safety consultant/laboratory to understand safety and certification issues

Breakdown of Efforts

- 2003-2005
  - 50/50 breakdown (fundamental vs. new materials)
  - Engineering bed effort growing
- 2006
  - 90% on materials with highest probability of achieving 6+ wt%
  - 10% screening new materials
    - Standing group available to screen and test materials and high-risk ideas needed, starting 2003
- 2007-2010
  - Focused on engineering and 1-2 materials (potential for 8+ wt%)

Effort Needed

- Doubling (or more) of fundamental NaAlH4 effort within next year
- Doubling (or more) of new materials development effort
- Sustained facility/group for rapid materials evaluation
- Growing industrial involvement
- 30 MM$ effort by 2007

6-10 Law

- 6-10 wt%
- 6-10 MJ/kg
- 6-10 MJ/L
- 6-10 x better desorption kinetics
- 6-10 x faster fill time
- (6-10 x better heat transfer)
- 6-10 years
- 6-10 x budget increase