EV Everywhere Workshop
July 26, 2012

BATTERIES

Materials Processing and Manufacturing

Breakout Session #1 – Discussion of Performance Targets and Barriers

Comments on the Achievability of the Targets

- PHEV40 and AEV 100 possible with success in current R&D
  - Achievable with Li-ion manufacturing improvements and advanced chemistries in current Li-ion R&D
- AEV300 more challenging
  - Requires manufacturing improvements and materials and chemistry improvements
- Quantify benefits/ drawbacks of fast charging vs. increased electrode cost

Barriers Interfering with Reaching the Targets

- Materials cost
  - Need: Material synthesis in large quantities/ with increased impurities and broader size distributions or advanced manufacturing
- Electrode thickness – manufacturing and performance
- Separator cost/ performance/ safety
- Organic solvent vs. dry processing/ alternate solvents
- Line speed vs plant footprint
- Formation cycling
  - Time, equipment, qualification, sorting

Breakout Session #2 – Discussion of Breakthroughs and Research Needs to Overcome Barriers and Reach Performance Targets

Technology Breakthroughs Needed

- Thick electrodes 2x
- Electrode processing cost reduction by 2x
- Low-cost synthesis of materials
- Formation cycling breakthroughs needed to significantly reduce the cost
- Streamlining assembly, high speed stacking to compete with winding
- All roll-to-roll processing, manufacturing, and assembly – no batch processing step

"Out-of-the-Box" Ideas

- Low-cost 3D battery
- Self organization
- Graded electrode porosity
- Engineering electrode on sub-micron scale
- Active separator

Research suggestions

NMP alternate or solvent free processing

Feedback to other groups, need from them

- Electrolytes, high-voltage high capacity cathodes, high performance anodes, understanding SEI formation
- Need to map cost of manufacturing and materials vs. charge time

Breakout Session #3 – Discussion of Action Plans and Next Steps

Comments Regarding the Other Technical Areas Being Discussed

- Li metal manufacturing
- Variability in cell manufacturing –intrinsic reduction and aging differences in pack?
- Understanding of manufacturing that would enable a better life prediction
- Road mapping – new materials time line will govern time line for manufacturing topics
- Bi-polar stack lithium ion will require transformational manufacturing
    - Sealing, current collector compatibility, electrolyte filling, volume change
- Thick alloy electrodes
    - Volume change, cost advantage?
- Air batteries – membrane technology for high selectivity vs. high permeability
- New chemistries – new production lines – difficult to encompass
- Wet processing – open formation cycling – healing damage introduced through water

DOE vs. Industry Role

- Industry gets more sensitive in scale up
- Funding mechanisms
    - Development program to demonstrate scaling of a system rather than a single component
    - Overcome proprietary issues in collaborative environments
    - DOE to establish a transparent framework for an open forum technology development
    - Manufacturing Demonstration Facilities for batteries? Is this feasible?