

Rapid Charging PM Discussion

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Discussion Framework

- **Assume that supporting system/infrastructure is a blackbox, what would be battery characteristics that allow rapid electric vehicle charging (≥ 30 miles/min)?**

Considerations for Battery Systems

- Continuous Level III rapid charging not allowed in many existing systems due to thermal and safety issues
- Dendritic growth limitations: with rapid charging, lithium diffusion limitations can lead to dendrites and possible fire/runaway events
- Internal resistance may need novel electrolytes that can also address heating issues
- Current technologies are stuck between 10^{-3} and 10^{-2} W/m²

Considerations for Battery Systems

- Anodic limitations of existing chemistries is a major limiting factor in preventing rapid EV charging due to the risk of lithium surface plating and unknown associated risks
- Need to have significant gains in anodic stability and safety to allow rapid charging consistently

Potential Opportunities & Areas of Need

- Self-Organized systems
 - ▶ Reduce manufacturing variability
 - ▶ Flexibility of cell assembly

- Anodes
 - ▶ Systems that prevent Li plating
 - ▶ Novel all-metal electrode assemblies
 - ▶ Carbon anode alternatives



Potential Opportunities & Areas of Need

- Solid State Electrolytes
 - ▶ Dendritic stability
- Cooling of Cells
 - ▶ Ultra-low resistive heating and/or low heat electrodes
 - ▶ Cooling of system at electroactive interface

Potential Opportunities & Areas of Need

- Novel Electrochemistry
 - ▶ New alloy formulations
 - ▶ Polymer based systems with high ionic conductivity
 - ▶ Rechargeable/Non-rechargeable Hybrid (Semi-rechargeable low cost systems)



Potential Opportunities & Areas of Need

- Separate energy systems for Power and Energy
- Additives & Coating (chemistry independent)
- Alternative ion chemistries
- Analyte/Cathlyte (improve E window stability)



Potential Opportunities & Areas of Need

- Advanced manufacturing
 - ▶ Novel approaches for architecture and interface
- Pulse chargeable systems
 - ▶ Allow for frequency tuned pulse charging

General Summary of Area Needs for 30 miles/min of charge

- IR Heating of electrodes at high rates
- Cooling of battery system
- State of Charge & State of Health before charging
- Grid Demands and Impacts