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Next Generation Transportation Batteries: Beyond Li Ion

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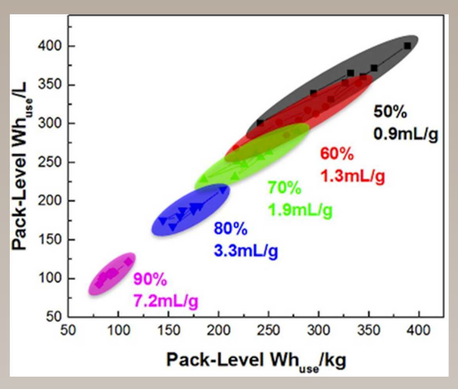
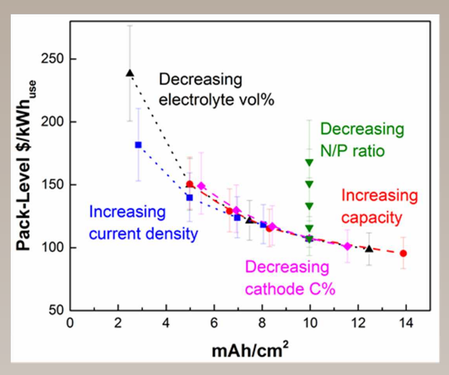
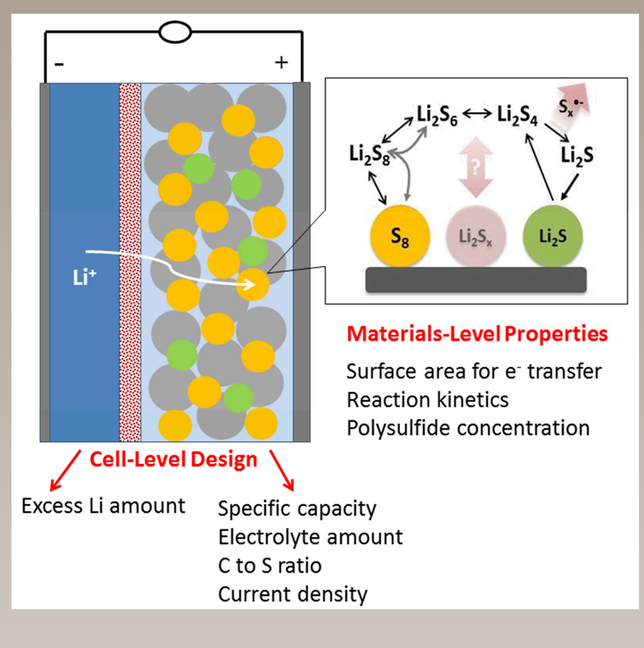
Redesigning the Li-S battery from the Materials Up

Techno-economic modelling argues 400 Wh/kg(L), $100/kWh pack level batteries are achievable

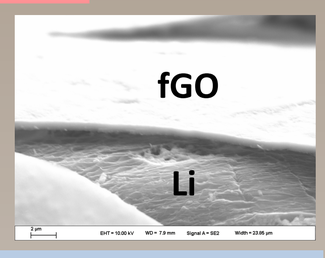






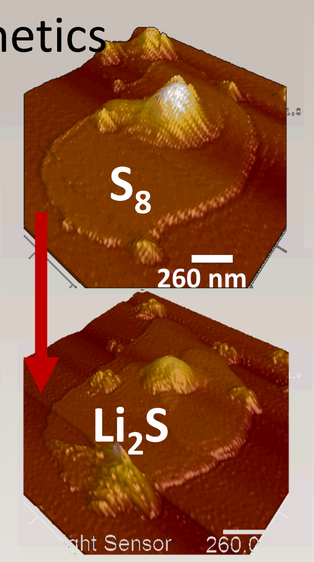
Protected Li Anodes

Membranes and films to eliminate parasitic reactions



Sparingly solvating electrolytes

Solvates to direct redox reactions
suppress polysulfide solubility
Diluents to enhance kinetics



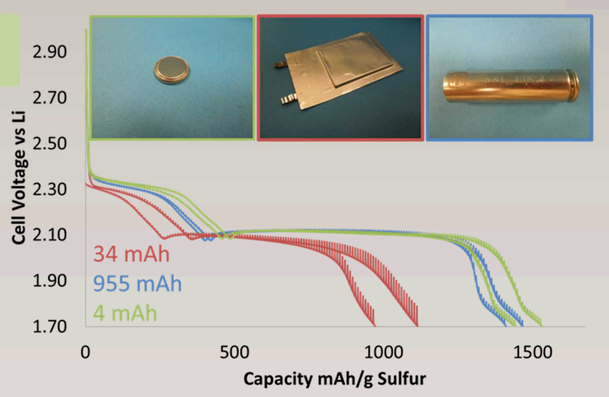
What is Required:

Stabilize Li metal anode
Eliminate polysulfide redox shuttle
Control state change reactions

New materials and concepts are required for a Li-S redesign

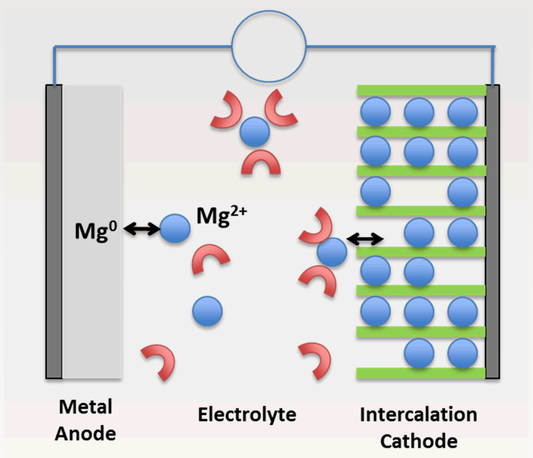
Multifunctional Sulfur Cathode

Binders as polysulfide absorbents and redox mediators
Modified cathode interface to control S_8 and Li_2S nucleation



Science Guided Development of Rechargeable Mg Batteries

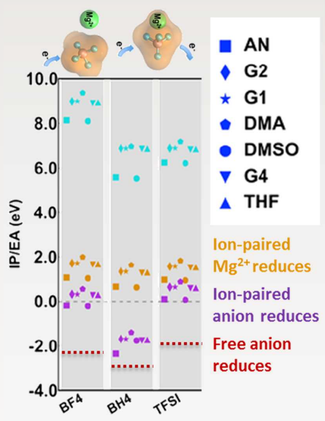
JCESR is targeting 400 Wh/kg, $100/kWh pack level Mg batteries

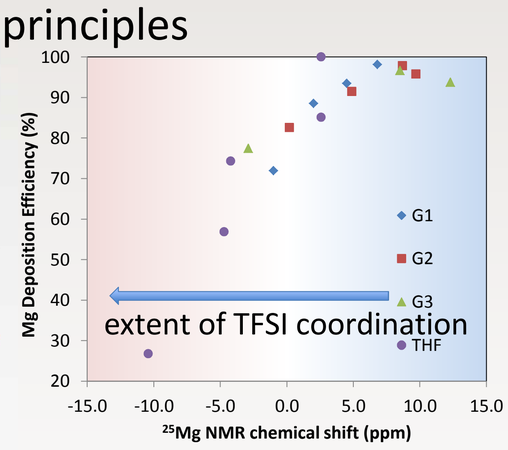


What is Required:

Electrochemically stable electrolyte
Stable Mg anode
High voltage, high mobility cathode

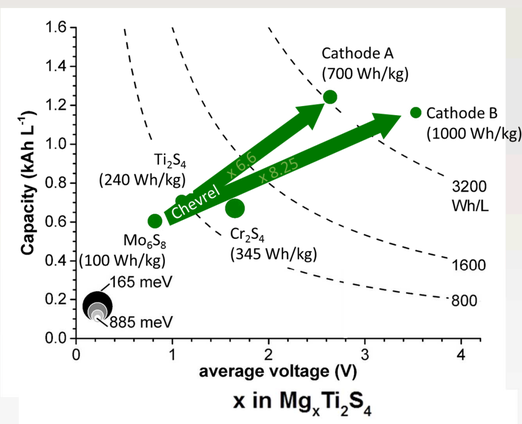
Determining universal electrolyte design principles

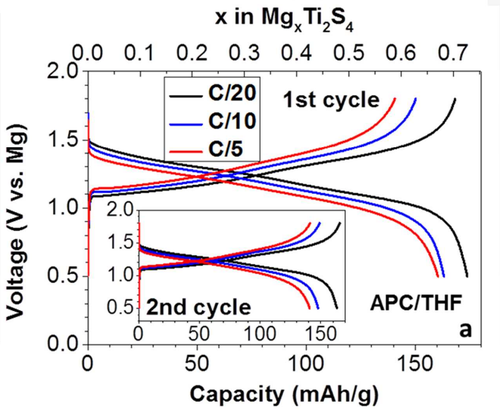




Stability and coordinating strength of anion and solvent molecule dictate efficiency

New cathodes identified & validated





What is Required:

Electrochemically stable electrolyte
Stable Mg anode
High voltage, high mobility cathode

Computationally guided material discovery with experimental validation

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U.S. DEPARTMENT OF ENERGY
National Nuclear Security Administration

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