

# **Pathways and Progresses in High Energy Rechargeable Lithium Batteries**

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Lithium (Li)-ion batteries play a critical role in energy and modern day technologies, but their specific energy and energy density are approaching the maximum practically achievable values. Developing the next generation rechargeable batteries with a specific energy higher than  $350 \text{ Wh kg}^{-1}$  is a high priority for the scientific community and for industry. Enabling the utilization of high capacity lithium (Li) metal anodes is the key to next generation rechargeable batteries. This paper discusses the scientific and technological challenges and potential solutions of utilizing Li metal anodes based on the detailed cell level requirements and parameters to achieve high energy density, including high efficient Li utilization, dendrite-free Li metal deposition and controlled SEI layers. The cell level understanding and validation of the materials properties for high performance and control of interfacial reactions across the whole cell will be explored. New concepts in cell design, emerging multifunctional materials and electrolytes/additives and their implications will also be discussed to significantly increase the cycling life under realistic testing conditions for high energy cells.