Lithium Metal vs. Li-ion Batteries: Challenges and Opportunities

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HQ initiated research on lithium rechargeable batteries with lithium metal and polymer electrolytes in 1979, Li/sulfur in 1982, and Li-air and Li-ion in 1995. Since that time, research on these battery chemistries has expanded worldwide. Several new polymers, solid electrolytes and ionic liquids with improved conductivity have resulted from a better understanding of the major parameters controlling ion migration, such as optimum polymer structure, phase diagram between solvating polymer and lithium salt, and the development of new lithium counter-anions. Despite the progress so far, the quest for a highly conductive dry polymer at room temperature is still continuing, and all-lithium polymer battery (LPB) developers presently face the challenge of whether or not to heat the polymer electrolyte to enable high-power performance, as required for electric vehicle and energy storage. LPB developers have explored both the high-temperature and low-temperature options.

This presentation provides an overview and progress status in developing four battery technologies:

1. Li-ion with $Li_4Ti_5O_{12}$ and graphite as negative and olivine (5 V oxide) as positive
2. Lithium-metal-based batteries with olivine ($LiFePO_4$) and dry polymer and ionic liquid-polymer electrolytes for rechargeable lithium batteries
3. All solid-state Li-sulfur batteries
4. Li-air batter$_i$es.

Please spell out with the composition of LTO.