OAK RIDGE NATIONAL LABORATORY
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Lithium-Conducting Sulfur Compound Cathode for Lithium-Sulfur Batteries

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Technology Summary

Lithium-sulfur batteries supply theoretical energy densities five times higher than lithium-ion batteries. Carbon materials are used to improve the poor electronic conductivity of the sulfur cathode, while the liquid electrolyte is the exclusively effective way to overcome its low ionic conductivity. However, the liquid electrolyte that has high solubility of polysulfides and sulfide leads to the polysulfide shuttle and subsequently very poor cycling performance. The present invention comprises a lithium-conducting sulfur compound with an ionic conductivity of 3.0×10-5 S cm-1 at 25 °C, which is 5 orders of magnitude higher than that of Li2S (2×10-10 S cm-1). This sulfur compound shows the near-theoretical capacity, which is 10 time the capacity of LiFePO4 and long-term cycleability over 300 cycles without significant capacity decay due to the elimination of polysulfide shuttle. It is contemplated that the present invention enables the development of diverse electrode materials for rechargeable lithium batteries with high energy densities.

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