

Lithium Super-Ionic Sulfide Carbon (LiSISC) Composite for Li-S Batteries

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Technology Summary

The present invention comprises a new material of Lithium Super-Ionic Sulfide Carbon (LiSISC) composite. LiSISC is an engineered nanomaterial of carbon, lithium sulfide, and sulfide-based super ionic conductors. The material is designed as the cathode for lithium sulfur batteries. The salient properties of this material are its superior ionic and electronic conductivities. Each component of the composite carries out one or more functions to enable the reversible electrochemical reaction of lithium sulfide during battery operations. Lithium sulfide, as an inexpensive active material, is used as the main component for energy storage. A super-ionic conductor coats the surface of lithium sulfide to form a core-shell structure. The super-ionic conductor shell facilitates the ingress and egress of lithium ions while preventing the undesirable dissolution of sulfur species in forms of polysulfides, which is believed to be the main component accounting for the polysulfide shuttle phenomenon. The super ionic conductor impedes the direct contact of the liquid electrolyte and lithium sulfide thus retards the degradation of the cathode material. The carbon materials provide an excellent electronic conductivity to the cathode. This new cathode material has an excellent cycleability and very high coulombic efficiency when it is cycled in a liquid electrolyte.

Inventor

LIANG, CHENGDU

Center for Nanophase Matls Sciences Div

Licensing Contact

SIMS, DAVID L

UT-Battelle, LLC

Oak Ridge National Laboratory

Rm 124C, Bldg 4500N, MS: 6196

1 Bethel Valley Road

Oak Ridge, TN 37831

Office Phone: (865) 241-3808

E-mail: SIMSDL@ORNL.GOV

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