Reaction Mechanism of Rechargeable Magnesium Sulfur Batteries

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Magnesium is an attractive candidate for an anode material with high energy density, low cost, and increased safety owing to its lack of dendrite formation.[1-3] These characteristics are especially relevant for the magnesium-sulfur battery, composed of magnesium metal anodes and sulfur composite cathodes, which is potentially one of the most promising battery systems with high energy densities beyond the limit of lithium ion batteries.[4-6] However, it is not well understood what the reaction mechanisms are, and in particular, the discharge reaction products have not yet been identified. Here we show that zinc blende magnesium sulfide was observed as a reaction product after discharging in magnesium-sulfur batteries. When magnesium reacts electrochemically with sulfur in a magnesium electrolyte, sulfur becomes amorphous consisting of magnesium and sulfur in the cathode. In this study, it has been found that the amorphous material has unique local structure, which was not related to the most stable rock salt phase of magnesium sulfide but rather the metastable zinc blende phase.

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