Encapsulation of sulfur using porous hollow carbon hosts for high performance lithium-sulfur batteries

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Currently used Li-ion batteries (LIBs) are approaching theoretical energy density. Therefore, many studies are being conducted to develop new energy storage devices to replace LIBs. Li-S batteries (LSBs) are one of the alternative technologies for LIBs, and can realize very high energy densities based on their high theoretical capacity. The critical problem with LSBs is the shuttle effect, which reduces the battery performance by blocking the pores of the separator and forming an insulating layer on the surface of the Li metal used as an anode.

In this study, hollow carbon (C) materials with different pore sizes as S hosts were prepared by a template method using silica nanoparticles. Owing to large pore volume (> 2 cc/g) of the hollow C host, C-S composites with relatively high loading of S with ~ 75% was obtained by infiltration of S within the C host. Subsequently, S-cathode with S content of ~ 53% was fabricated and their electrochemical performance in a LSB was evaluated. We found that heat treatment conditions such as temperature and/or treatment time had a decisive effect on characteristics of resultant hollow C hosts and their electrochemical performances.