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# Hollow carbon spheres with nanoporous shells and tailored chemical interfaces as sulfur host for long cycle life of lithium sulfur batteries

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**Abstract**: Lithium sulfur batteries suffer from poor cycle life mainly due to the shuttle effect of dissolved polysulfides and volume expansion of electrode. Herein, we report hollow carbon spheres with nanoporous shells and tailored chemical interfaces (PHCS) via annealing precursors under hydrogen contained inert gas as sulfur host to realize ultralong cycle life of lithium sulfur battery. The obtained PHCS has a larger pore volume, a higher specific surface area and less oxygen content compared to the conventional treated HCS. Benefiting from the combination of the unique pore structure and chemical interfaces which induce stronger polysulfides adsorption ability and less unwanted side reactions, which were confirmed by the ultraviolet-visible (UV-vis) spectroscopy test and XPS measurement, the obtained PHCS/S cathode demonstrate excellent rate performance and ultralong cycle life. It delivers a high discharge capacity of 806.3 $mAhg^{-1}$ at 4C rate and an ultralong cycle life with a low capacity decay rate of 0.037% after 1500 cycles at 2C rate. Moreover, it also supports high sulfur content (82%) and loading (7.2 mg $cm^{-2}$) with good electrochemical performance. The EIS analysis and post-mortem SEM measurements further confirm that the PHCS/S cathode electrode has more stable resistance and morphology characteristics, and the corresponding lithium anode suffers less structural destruction and volume expansion, which may lead to the excellent battery performance.