Research & Reviews

Journal of Material Sciences

ISSN: 2321-6212

2020

Vol.08 No.4

In-situ anchoring sulfiphilic silica nanoparticles onto macro-mesoporous carbon framework for cost-effective Li-S cathodes

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Abstract

Conductive porous carbons have emerged as the leading hosts for constructing cathodes of lithium-sulfur batteries but are currently challenged by poor surface chemistry and cost-effective synthesis. Herein, a 3D hierarchical macro-mesoporous carbon with in-situ silica anchoring (SMC) was prepared via an economical and high-throughput sol-gel approach. In this strategy, interconnected macropore channels, abundant mesopores and well-distributed silica nanoparticles are synergistically integrated into a conductive framework constructed by carbon nano-particles accumulation, and the tunable content of silica can also be achieved simultaneously. The 3D conductive network and interconnected hierarchical porosities endow the carbon matrix multifaceted structural merits for promoting electrons/ions transfer and homogenizing sulfur dispersion. In addition, the LixSy (S8 and polysulfides) mobilization is dramatically restrained through chemical binding between silica and LixSy, which is confirmed by DFT studies. Benefiting from these unique merits, the batteries delivered a high reversible capacity of 969.7 mAh g-1 and enhanced capacity of 625.5 mAh g-1 with a capacity fading rate of only 0.088% per cycle after 400 cycles at 0.2 C. This strategy may provide a new perspective to surface chemistry modification of carbon-based sulfur hosts material with low cost and simple approach to ultimately advance energy conversion and storage system.

Biography:

Mrs.Yajing Liu is a PhD student in Inner Mongolia University of Technology.

26th International Conference on Advanced Materials, Nanotechnology and Engineering June 22-23, 2020.

Abstract Citation:

Mrs.Yajing Liu In-situ anchoring sulfiphilic silica nanoparticles onto macro-mesoporous carbon framework for cost-effective Li-S cathodes 2020, 26th International Conference on Advanced Materials, Nanotechnology and Engineering
June 22-23, 2020

https://advancedmaterials.conferenceseries.com/poster-presentation.php