Journal of Nanomaterials

Hindawi

Special Issue on
Nanomaterials for Electrochemical Conversion Metal-Sulfur Batteries

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The increasing demands for power sources with high energy density, long operation lifetimes, and high system stability have led the research community to the development of new battery chemistry for advanced energy storage systems. The development and future commercialization of electrochemical conversion metal-sulfur batteries has great potential to be one of the great successes of modern energy-storage technology.

Metal-sulfur batteries involve different metal anodes, including lithium, sodium, potassium, magnesium, and aluminum. These metal anodes either have high charge-storage capacity or are naturally abundant in the Earth. Coupling with sulfur-based cathodes (sulfur, polysulfide, sulfide, selenium, etc.), the metal-sulfur cells using low-cost materials could reach high energy density values of up to 2500 W h kg^{-1} and 2780 W h L^{-1}, which are much higher than those of current commercial lithium-ion batteries. In order to attain the highest electrochemical efficiency, these new battery chemistries need more detailed material design and performance optimization.

Advances in nanomaterials have enabled the fabrication of new electrochemical energy-conversion and energy-storage materials with progressing performances. The unique morphologies and microstructures of nanomaterials enable active materials and electrode materials to possess enhanced electrochemical characteristics and boost the specific capacity, cycle stability, and discharge/charge efficiency. Thus, nano-sized energy storage materials used in both cathode and anode as active materials and electrode substrates are able to optimize metal-sulfur battery performances. In addition, with the support of nanotechnology in electrochemical, structural, and reaction analyses, the investigation of battery reaction mechanisms shows scientific insights for further benefiting the processes optimization and devices' practicality. Therefore, nanomaterials and their related synthesis, preparation, and analysis will allow us to establish comprehensive understandings on the electrochemistry, mechanisms, and kinetics of new metal-sulfur batteries.

The aim of this special issue is to collate original research papers and review articles focused on various aspects of metal-sulfur batteries employing nanomaterials and their synthesis, preparation, and analysis.

Potential topics include but are not limited to the following:

- Nanostructures and nanomaterials for advancing metal anodes, such as lithium, sodium, potassium, magnesium, and aluminum.
- Nanostructures and nanomaterials for sulfur-based cathodes
- Nanomaterials and related designs for understanding the metal-sulfur electrolyte/electrode interface
- Nanomaterials for addressing the degradation of electrode materials

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Papers are published upon acceptance, regardless of the Special Issue publication date.

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