Preparation and Electrochemical Properties of Gadolinium Oxide –doped Carbon Aerogels/Sulfur Composites

Anqiao Zheng¹, Rui Liang², Han Wu¹, Guodong Jiang^{1,3}, Mingxia Fan^{1,3}, Jian Xiong^{1,3}, Songdong Yuan^{1,3,*}

¹ Hubei Collaborative Innovation Center for High-efficiency Utilization of Solar Energy, Hubei University of Technology, Wuhan 430068, China

² Sunwoda Electronic Co.,Ltd, Shenzhen 518108, China

³ The Synergistic Innovation Center of Catalysis Materials of Hubei Province, Wuhan 430068, China

*E-mail: 171245675@qq.com

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A carbon aerogel (CA) was successfully synthesized by a sol-gel method combined with freeze-drying, followed by solution permeation impregnation and high-temperature carbonization to obtain a gadolinium oxide (Gd₂O₃)–doped CA composite (CA@Gd₂O₃). Then, CA@Gd₂O₃ was incorporated with sulfur by the melt-diffusion method to obtain CA@Gd₂O₃@S composites, which exhibited a superior electrochemical performance. The initial discharge specific capacity of the composite reached 1168.4 mAh/g at 0.1 C and maintained a reversible specific capacity of 814.4 mAh/g after 100 cycles. The outstanding electrochemical properties were mainly attributed to the strong polar adsorption of polysulfides by the abundant O²⁻ ions on the surface of Gd₂O₃, which inhibited the shuttle effect of polysulfides. Moreover, the CA doped with Gd₂O₃ maintained a high specific surface area and large pore capacity to alleviate the poor electrical conductivity and volume expansion effect of sulfur cathode materials.

Keywords: lithium-sulfur battery, carbon aerogel, Gd₂O₃, shuttle effect, cathode

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