三维石墨烯/硫的可控组装及其储锂性能研究

刘东海 [1]，张辰 [1]，杨全红 [1,*]

[1] 天津大学化工学院，天津，300072

*Email: qhyangcn@tju.edu.cn

锂硫电池以其能量密度高、硫资源丰富、环境友好等特点受到了广泛的关注和研究，成为了极具发展潜力的新一代储能装置。本文以石墨烯为基元载体材料，利用一步水热法实现了石墨烯基碳/硫三维多孔材料的制备，并对其结构及电化学行为进行了系统表征。

石墨烯基碳/硫复合材料具有三维多孔结构，石墨烯片层相互搭接形成良好的多孔三维导电网络，硫能够均匀沉积在石墨烯片层上。采用不同干燥方式可以有效调控石墨烯基三维宏观体的微观结构和孔径分布，获得密度和孔容可调的三维结构。采用烘干干燥的方式制备的三维石墨烯基碳硫复合材料，具有更为紧密的三维结构，可以提高对单质硫和多硫化物的限域效应。电化学测试结果显示，冻干样品的初次放电容量可以达到 1100 $mAh\cdot g^{-1}$；而在 500 mA g^{-1} 的充放电电流密度下，烘干样品的初次放电容量可以达到 850 $mAh\cdot g^{-1}$，300 圈之后的容量仍然保持 300 $mAh\cdot g^{-1}$，作为锂硫电池的正极材料具有良好的应用前景。

关键词：锂硫电池；石墨烯；三维结构

参考文献

[1] Ji, X L; Lee, K T; Nazar, L F. *Nature materials.* **2009**, **8**: 500—506.

[2] Lv, W; Tao, Y; Ni, W; Zhou, Z; Su, F. Y; Chen, X. C; Jin, F. M; Yang, Q. H. *Journal of Materials Chemistry*.**2011**, **21(33)**: 12352—12357.

[3] Tao, Y.; Xie, X. Y.; Lv, W.; Tang, D. M.; Kong, D. B.; Huang, Z. H.; Nishihara, H.; Ishii, T.; Li, B. H.; Golberg, D.;Kang, F.Y.; Kyotani, T.; Yang, Q. H. *Scientific Reports.* **2013**, **3**, 2975.

Fabrication of 3D graphene/S macroassembly and its use for Li-S battery

Donghai Liu[1], C Zhang [1], Q.-H. Yang [1,*]

[1] School of Chemical Engineering and Technology, Tianjin University, Tianjin 300072

As a novel energy storage device, Li-S batteries have drawn extensive attentions due to their high energy density, environmental friendly and low cost. In this study, three-dimensional graphene/S composite (G/S) is prepared by a one-pot hydrothermal method, which involves redox reaction of S-based compound and graphene oxide (GO). G/S has a three dimensional porous structure, and the graphene layers are connected to each other to form a 3D conductive network. It is demonstrated that the pores structure can be precisely controlled by adjusting the drying method of the 3D graphene-based materials. Freeze drying and evaporation-induced drying can induce different density and porous structure of G/S. Electrochemical tests illustrate that the resulting composite can deliver a specific capacity of 850 $mAh\cdot g^{-1}$ and 300 $mAh\cdot g^{-1}$ for the first and 300^{th} charge process at a current density of 500 $mA\cdot g^{-1}$.