学 术 报 告

State Key Laboratory of Chemical Resource Engineering

新能源存储中的空间限域化学反应研究

报 告 人： 孙 洁 教授 天津大学

时　　间： 2017年9月11日（周一）上午 9:00-10:30

地　　点： 中心会议室

报告人简介：

2006-2012年，在北京化工大学分别获得学士、博士学位。博士期间主要从事锂离子电池、超级电容器和电催化方向的研究。2013-2017年，在美国斯坦福大学 崔屹教授课题组作博士后研究工作，主要研究方向包括锂离子电池、钠离子电池、锂硫电池、二维材料的研究。2016年入选天津市千人计划青年项目，2017年入选第十三批国家千人计划青年项目。2017年，任职于天津大学化工学院教授。研究工作发表在Nature Nanotechnology，Nature Energy，Advanced Materials, PNAS，Energy & Environmental Science，Angew. Chem. Int. Ed., Nano Lett.上，共30余篇，其中第一作者文章10篇，总被引为1000余次。获得美国授权专利2项，中国授权专利5项。担任Nano Letters (IF=13.592)，Nano Energy (IF=10.325)，Small (IF=8.315), Energy Storage Materials， Ceramics International (IF=2.605)， Colloids and Surfaces B: Biointerfaces (IF=4.152), Solid State Ionics (IF=2.112) 等刊物审稿人。

报告内容简介：

Lithium-ion batteries (LIBs) have been highlighted to replace the current oil-driven vehicles in order to reduce the usage of oil resources and generation of CO2 gases, dominating the current worldwide rechargeable battery market due to their outstanding energy and power capability. With rising demand leading to increasing cost of LIBs, sodium-ion batteries (SIBs) play a significant role in sharing the responsibility with LIBs. Recently, although successful reports on SIB cathode materials have shown performance comparable to their LIBs counterparts, the major scientific challenge is to develop a new anode material.Phosphorus reacts electrochemically with both lithium and sodium to form Li3P and Na3P for an anode material and with a high theoretical specific capacity of 2596 mAh/g, which significantly exceeds that of any other sodium-ion battery anode presently available. Moreover, phosphorus has a better electronic conductivity and smaller energy barrier for Li+ diffusion than silicon. Phosphorus has been investigated previously as an anode material for both lithium-ion and sodium-ion batteries, but its huge volumetric expansion results in a modest cycle life and rate performance. It is therefore important to investigate the mechanism in order to optimize the performance of phosphorus. However, the lithiation/sodiation mechanism in phosphorus has been rarely reported in the literature. Here, we investigated the lithiation/sodiation mechanism in two allotropes of black and red phosphorus. The microscopic topology of phosphorus were prepared and used as anodes for lithium and sodium ion batteries. We also studied the relationship between microscopic topology and electrochemical performance. Based on the above findings, the microscopic topology of phosphorus/carbon were designed to confine the volumetric expansion in an atomic-scale space, leading to a stable structure and good electrochemical performance for lithium/sodium-ion batteries, including a long life, high energy density and power density.

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