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《碳纳米材料电化学》专辑序言
——方兴未艾的电化学能量转换和存储先进材料和技术

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可以预见,在相当一段时期内能源和环境将是全球发展的两大主题. 其实,人类对能源的获取方式将对地球的生态环境和人类未来的生存状态和生活方式产生重要影响. 正因为如此,世界各国正在大力发展可再生能源和清洁能源. 电化学能源是将化学能高效转变为电能的一种能量转换方式,它历史悠久,但不断改进和创新,尤其是近年来得到了较快的发展. 目前,电化学能源转换和存储器件主要包括一次电池(如锌锰电池等)、二次电池(如铅酸电池、镍氢电池、锂离子电池等)、燃料电池、金属-空气电池以及超级电容器等. 电化学能源和其它可再生能源相互补充、交叉利用将是未来清洁能源的主要发展方向.

电极材料是电化学能源高效转换和存储的基础和核心之一. 在已开发的电极材料中, 碳材料是应用最为广泛的材料之一. 近年来, 各种一维、二维和三维碳材料已被广泛应用于电化学能源转换和存储器件,包括活性炭、碳纤维、介孔碳、碳纳米管、石墨烯、泡沫碳等. 由于碳材料具有化学稳定性高、导电性能好、质量轻以及电化学窗口宽等优点,作为电极材料表现出优异的电化学性能. 同时, 碳材料较宽的双层电容性能使其在双电层超级电容器应用中具有其它材料无法比拟的优越性. 除了在电化学能源转换和存储中的应用,碳材料的大比表面积特性,使其成为电催化剂的良好载体. 近年来,随着对非 Pt 和低 Pt 电催化剂研究的深入,发现杂原子掺杂和修饰的碳材料,特别是碳纳米管和石墨烯材料对燃料电池阴极氧还原反应具有较好的电催化性能. 基于碳材料的低成本电催化剂有望应用于实际燃料电池中, 从而有助于燃料电池的大规模商业化. 另外, 通过对基于碳材料的电极表面进行修饰和功能化,在电分析化学和电化学传感领域具有重要的应用.

由于碳材料具有优异的电化学性能和重要的实际应用价值,近年来,我国相关研究人员在碳材料开发、结构和性能研究以及在电化学应用等方面做出了卓有成效的工作, 并获得了高水平的研究成果. 本专辑主要收录了在该领域具有丰富研究经验的团队所撰写的 6 篇相关研究进展的综述文章和研究论文, 涵盖了碳材料的电化学制备和碳材料在锂离子电池、超级电容器、燃料电池电催化剂领域的应用等研究成果, 较为全面地反映了我国在碳材料电化学领域的研究进展和研究方向. 希望借助该专刊的出版, 能使广大读者更深入地了解碳材料电化学领域的研究现状、研究趋势和存在的问题及挑战,为该领域研究提供参考,推动我国碳材料电化学研究的进一步发展.

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Special Issue: Electrochemistry of Carbon Materials

Carbon materials are traditional electrode materials due to their excellent electrical conductivities, high electrochemical stabilities and wide potential windows. Glassy carbon, graphite, various activated charcoals, carbon fibers etc. have been widely used in electrochemistry serving as electrode substrates or supports. In addition to their applications in basic electrochemistry, carbon materials have also played important roles in electrochemical energy storage and conversion. In recent years, various types of carbon structures, from zero-dimensional carbon nanodots, one-di mensional nanotubes, two-dimensional graphene to three-dimensional porous carbons, have attracted increasing attention in electrochemical field. It has been found that carbon materials have outstanding properties as advanced electrochemical energy storage materials, and can be applied as supercapacitors and electrode materials for lithium-ion batteries, as well as advanced supporting materials for electrocatalysis and electroanalysis. Moreover, recent studies showed that heteroatom-doped or surface-functionalized carbon materials represent one of the most promising noble metal- or metal-free electrocatalysts for fuel cells. In recent years, scientists and technologists from China have made great contributions to the development in electrochemistry of carbon materials, and breakthrough has been achieved in this field, including design and synthesis of novel structure, studies in properties and applications of carbon materials in electrochemical energy-related fields.

To provide a comprehensive review in the achievements that have been made and to promote the further development in electrochemistry of carbon materials in China, some leading scientists have been invited to discuss the recent advances and the future direction in this field. I wish to take this opportunity to thank all the authors, reviewers, and editorial staff of *Journal of Electrochemistry* for their professional contributions to this special issue.

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