

《电催化与电合成》专辑序言

程方益¹, 王双印², 周天华³

1. 南开大学化学学院, 天津 300071
2. 湖南大学化学化工学院, 湖南 长沙 410082
3. 中国科学院福建物质结构研究所, 福建 福州 350002

电催化作为纳米材料、能源化学和环境保护等领域的研究热点, 是发展可持续清洁能源技术的基础学科, 在反应过程中涉及到物质转化和能量转化及其普适规律。电合成是在电催化基础上与有机合成和化学工程等学科进行交叉, 形成一门“古老的方法、崭新的技术”的交叉学科, 在可再生能源和温和条件下高效高选择性地合成有机化学品。随着科学快速发展, 电催化与电合成借助于各种新兴技术(如同步辐射光源、超级计算机、微纳/显微)取得了卓著的成果, 对催化活性位点的设计、催化机理的理解、电子/离子的传输及其与物质分子的相互作用等均有深入发展。

近十多年来, 电催化与电合成在基础理论和应用研究方面都展现了很多的新颖、前沿的热点研究方向, 持续吸引着科研人员的关注和投入, 不断融合材料、能源、环境、信息、AI 智能等学科知识, 迎来一个黄金发展期。当前, 国内科研人员在电催化与电合成领域取得了巨大发展, 先后提出了研究电催化与电合成的新视角、新材料和新反应体系。在大量前期工作的积累下, 电催化与电合成的理论知识和实验技术已处于临界突破节点, 在可预见的未来将会有重大的成果和应用面世。未来的电催化与电合成的发展将遵循可持续发展的理念, 充分利用新型可再生能源, 在环境友好和安全化学条件下推动物质与能量的转化, 成为一种有生命力的基础学科。

《电催化与电合成》专辑(2023年第1期和第2期)刊登了在国内电催化与电合成领域具有丰富研究经验团队的8篇论文, 包括4篇综述论文和4篇研究论文。专辑涉及高活性、高稳定性的无铂族金属氧还原催化剂的最新研究进展、瓜环基金属纳米催化剂的电化学研究进展、钌电极电化学氧化乙烯的研究结果、类超晶格结构有序性传质赋予燃料电池高品质输出性能、锂氧电池阴极材料的进展和挑战、固态氧化物电解池阳极材料最新进展、阳极甘油氧化电催化的碱/酸混合电解制氢研究、层状金属氢氧化物中铁位点辅助分散铂纳米颗粒用于高效甲醇氧化等。愿借此专辑, 为读者了解和深入开展电催化与电合成领域的研究提供参考, 以期为推动我国电催化与电合成技术的进一步发展贡献绵薄之力。

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程方益: Tel: (86-22)23497717, E-mail: fycheng@nankai.edu.cn

王双印: Tel: (86-736)88821076, E-mail: shuangyinwang@hnu.edu.cn

周天华: Tel: (86)13599434968, E-mail: thzhou@fjirsm.ac.cn

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Preface to Special Issue on Electrocatalysis and Electrosynthesis

Fang-Yi Cheng¹, Shuang-Yin Wang², Tian-Hua Zhou³

1. College of Chemistry, Nankai University, Tianjin 30071, China

2. College of Chemistry and Chemical Engineering, Hunan University, Changsha 410082, Hunan, China

3. Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou 350002, Fujian, China

As a research hotspot of the fields of nanomaterials, energy chemistry and environmental protection, electrocatalysis is a fundamental subject for developing the sustainable and clean energy technology. During the process, electrocatalysis involves the transformation between electric energy and chemical materials. On basis of the electrocatalysis, electrosynthesis is an interdisciplinary subject by integrating the subjects of organic synthesis and chemical engineering, which is called as the subject of “old method, new technology”. Electrosynthesis can efficiently and selectively realize the synthesis of organic chemicals under mild conditions driven by sustainable energy sources. With the rapid development of society, electrocatalysis and electrosynthesis with the aid of various emerging technologies (e.g. synchrotron radiation source, supercomputer, and micro-nano/microscopy) have obtained outstanding achievements, which focused on the design of catalytic sites, understanding of work mechanism, transfer of electrons/ions and interaction between matters and electrons/ions.

Over the past decade, there have been many new frontier and hot topics in both fundamental and applied aspects of electrocatalysis and electrosynthesis. Numerous scientific researchers have committed oneself to these topics and continually blended with the knowledge of materials, energy, environment, information, and AI intelligence, leading to a golden period of development for electrocatalysis and electrosynthesis. Currently, the domestic researchers have acquired some huge developments, which proposed new perspectives, novel materials and new reaction systems in electrocatalysis and electrosynthesis. Based on the accumulated preliminary work, the theoretical modeling and experimental methods are all at the key nodes to break through the limitations of previous limit. There will be more breakthroughs in the foreseeable future. The future development of electrocatalysis and electrosynthesis should follow the rule of sustainable development, take full advantage of novel renewable energy sources, and promote the transformation of matter and energy under safe and eco-friendly conditions. Electrocatalysis and electrosynthesis will become a vital foundation subject.

This special issue (consecutively published in the journal's first and second issue in 2023) consists of 8 papers written by teams rich in experience in related research fields, including four review papers and four research articles. It covers the scientific and technical problems faced by electrocatalysis and electrosynthesis, focusing on “Recent Advances in Exploring Highly Active & Durable PGM-Free Oxygen Reduction Catalysts”, “Research Progress in Cucurbit[n]uril-Based Metal Nanomaterials for Electrocatalytic Applications”, “Electrochemical Oxidation of Ethylene on Palladium Electrode”, “Supperlattice-Like Structure: Ordered Mass Transfer Endows High Quality Output of Fuel Cell”, “Advances and Challenges on Cathode Catalysts for Lithium-Oxygen Batteries”, “Recent Advances in Anode Materials of Solid Oxide Electrolysis Cells”, “Anodic Electrocatalysis of Glycerol Oxidation for Hybrid Alkali/Acid Electrolytic Hydrogen Generation”, and “Highly dispersed Pt Nanoparticles Root in Single-Atom Fe Sites in LDHs towards Efficient Methanol Oxidation”. Hopefully, this special collection will provide the knowledge to the readers for conducting in-depth research in the subject and developing the electrocatalysis and electrosynthesis in China.

With this preface, we would like to express our heartfelt thanks to all the authors, reviewers and editorial staff for their hard and fruitful work!