Primer seminario:

Materials Innovation for Energy Storage and Conversion

Prof. Shi-Zhang Qiao

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- **Jueves 4 de septiembre a las 10 hs.**
- **Aula: RFP 3er piso DQIAQF/INQUIMAE**

Resumen

The emerging electrocatalytic refinery (E-refinery) promisingly leads to defossilization, decarbonization, and decentralization of chemical industry. Specifically, powered by renewable electricity (e.g., solar, wind and hydro power), oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) can efficiently split water into green hydrogen. A crucial step in realizing this prospect is the knowledge-guided design of optimal electrocatalysts with high activity and selectivity. In this presentation, I will talk about our recent progress in mechanism understanding and material innovation for electrocatalytic seawater splitting for green hydrogen production.
Aqueous zinc-based batteries (AZBs) and metal-sulphur batteries (MSBs) hold significant potential for energy storage due to their low cost, high safety, impressive energy density, and environmental friendliness. However, they face major challenges for commercialization, including the lack of advanced cathode materials for AZBs and slow reaction kinetics for MSBs. For AZBs, I will introduce our latest advancements that demonstrate the exceptional durability of Zn-I2 batteries in industrial-scale pouch cells, which are operated under conditions of high active mass loading for cathodes and limited Zn supply for anodes. I will show our new efforts to harness the reversible four-electron I−/I2/I+ conversion electrochemistry, aiming to enhance the energy density of Zn-I2 batteries. For MSBs, I will introduce our recent research progress on developing fundamental designing principal of nanocomposite catalysts capable of enabling high-power performance in Li||S battery systems.

Referencias:

[1] J.X. Gao, et al., Nat. Energy 8, 264-272 (2023).
[2] X.G. Sun, S.Z. Qiao, et al., Nat. Commun. 15, 10351 (2024).
[3] H. Li, S.Z. Qiao, et al, Nat. Nanotech. 19, 792-799 (2024).
[4] H. Wu, S.Z. Qiao et al, J Am Chem Soc 146, 16601-16608 (2024)
[5] S.J. Zhang, S.Z. Qiao et al, J Am Chem Soc 147, 16350-16361 (2025)

Segundo seminario:

Nanostructured and Nanoporous Materials: Synthesis and Applications

Prof. Chengzhong Yu

Australian Institute for Bioengineering and Nanotechnology, The University of Queensland, Australia

- **Jueves 4 de septiembre a las 11:15 hs.**
- **Aula: RFP 3er piso DQIAQF/INQUIMAE**

Resumen

Nanoporous materials with diverse compositions and controllable pore structures have received extensive attention. Construction of nanostructured and nanoporous materials has enabled new opportunities in understanding the fundamental structure-property relationship in diverse research areas. My group focuses on the synthesis of nanostructured and nanoporous materials as well as their applications in drug delivery and catalysis. In this talk, I will give an overview of our recent progresses.

Firstly, mesoporous nanoparticles for drug delivery applications will be presented.[1] Nanoparticles have been applied as various drug delivery systems, conventionally as “nanocarriers” to deliver drug molecules for controlled release. We have shown that nanoparticles designed as both “carriers” and “biomodulators” are advanced drug delivery systems with unprecedented functions that cannot be obtained before. This concept has been recently applied in gene delivery and cancer nanoimmunotherapy, harnessing the chemistry of designed nanoparticles to regulate bio-signalling for immunotherapy.

In the second part, anisotropic nanostructured metal-organic frameworks (nMOFs) will be introduced. MOFs have intrinsic molecular and nanoscale anisotropy, the latter is significantly amplified via nanosizing and control over facet exposure. The combination of both molecular and nanoscale engineering is a new strategy to enhance the functions of anisotropic nMOFs, yet this research area is still at its infancy. I will introduce our recent progresses in anisotropic nMOFs and their application,[2] including strategies to increase atomic anisotropy (e.g., mixed metal ions / ligands, modulating ligands) and nanoscale anisotropy (e.g., facet control and nanoarchitectonics. The resultant materials exhibit superior catalytic performances such as oxygen / nitrogen reduction reactions.[3]

Referencias:

[1] Adv. Mater. 202401504. Nat. Commun. 2024, 15(1), 1891. Nano Lett. 2024, 24 (15) 4354. Sci. Adv., 2023, 9 (40), eadi7502. Angew. Chem. e202112752. Nat. Rev. Mater. 2021, 6(12), 1072. Acc. Chem. Res. 2020, 53; 1545. [11] Angew. Chem. 2020, 59 (52), 23374; Adv Mater. 2020, 32, 1904106.
[2] Angew. Chem. e202209433. Coord. Chem. Rev. 2024, 510, 215815.
[3] Adv. Mater. 202500399; Adv. Mater. 202416210; Angew. Chem. e202505046; Angew. Chem. e202412340. Angew. Chem. e202413866. Angew. Chem., e202409163. Adv. Mater. 2024, 2313844. Angew. Chem. e202409799. Angew. Chem. e202314266. J Am. Chem. Soc. 2023, 7791. Angew. Chem. e202314266. Nat. Comm. 2023, 14 (1) 5780. Nat. Sustain. 2025, DOI: 10.1038/s41893-025-01538-4.