Chemically Robust Metal–Organic Framework-Based Nanocomposites for Electrochemical Energy Storage and Conversion

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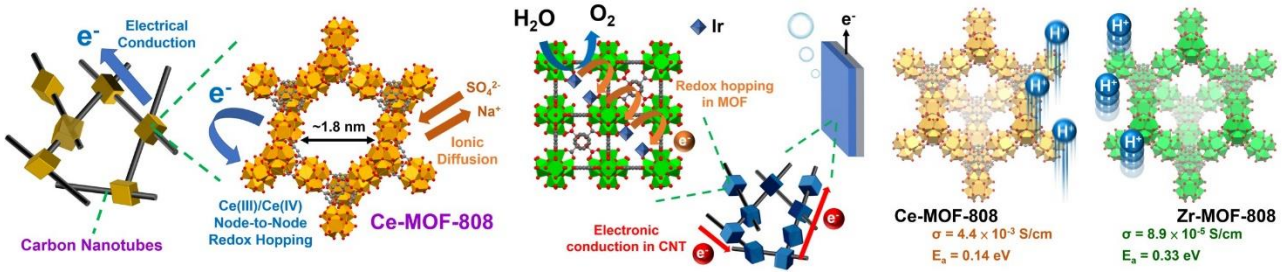
Given several advantages of metal–organic frameworks (MOFs) including regular porosity, ultrahigh specific surface area, and periodic intra-framework functionality, MOFs have been considered as desirable materials for various electrochemical applications including electrocatalysis, electroanalysis, and energy storage [1]. However, as described in our recently published review articles, the electrically insulating nature and relatively poor chemical stability of most MOFs strongly limit the use of pristine MOFs in these applications [1-2].

In this talk, various strategies that render the use of chemically stable MOF-based nanocomposites for electrochemical energy storage and conversion developed by our research group during 2020-2021 will be highlighted. The use of highly water-stable group 4 metal (Zr or Ce)-based MOFs would ensure their structural integrity during electrochemical operations, and the design of electrically conductive MOF-carbon nanocomposites would facilitate the interparticle electrical conduction between MOF crystals [3]. With such rational material designs, these electrically conductive MOF-based nanocomposites could provide enhanced performances in supercapacitors as well as act as remarkable electrocatalysts for electrochemical oxygen evolution. In addition, the fundamental ionic conducting properties of these water-stable MOFs are also highly tunable by adjusting the type of group 4 metal presented within the metal-based nodes [4]. These ideas are briefly depicted in the Figure below.



References:

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