Exploring conjugated units in covalent organic frameworks for optimized lithium ion storage

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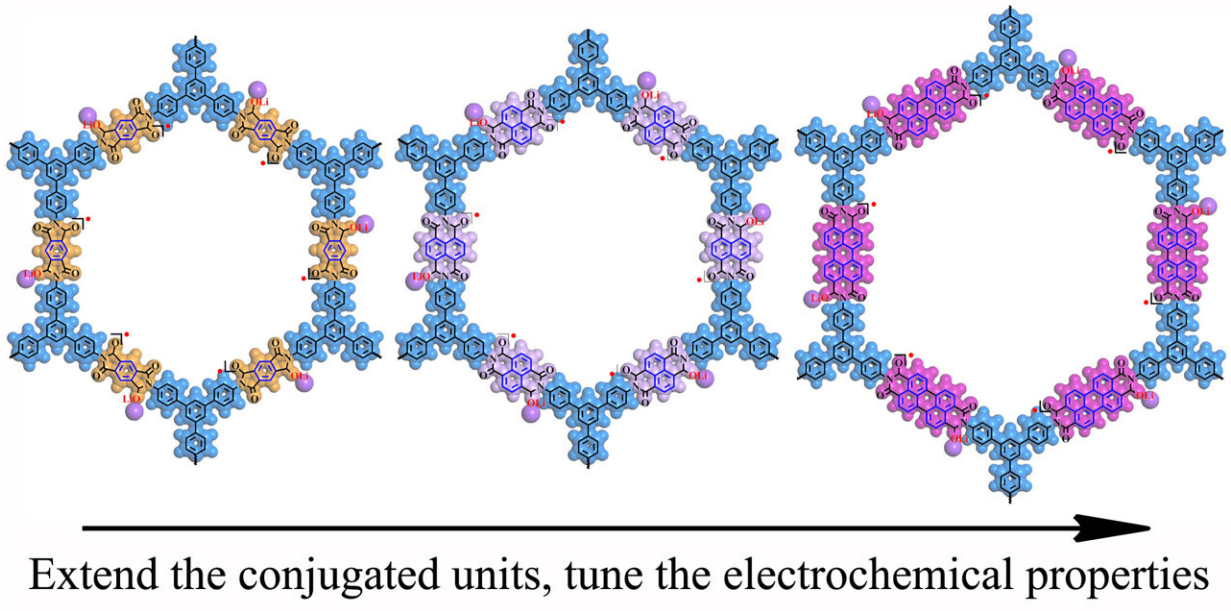

Regulating the conjugated units in COFs can effectively modulate the redox activity and stability of radical intermediates, endowing the electrodes with tunable initial capacities, discharge voltages, rate performance and cycling stabilities. Credit: Journal of Energy Chemistry

Organic radicals are crucial intermediates generated during the redox processes of organic electrode materials. However, the poor stability of organic radicals often results in the capacity fade of organic electrodes,

and their stabilization mechanism is rarely explored. Additionally, the structure-property relationship between the organic radicals and the resultant organic electrodes is rarely reported. Therefore, finely regulating the stability of organic radicals to optimize the electrochemical performance of organic electrodes remains a significant challenge.

Recently, an article titled "Regulating the radical intermediates by conjugated units in covalent organic frameworks for optimized lithium ion storage" co-authored by Prof. Zhouguang Lu from SUSTech and Prof. Kaili Zhang from CityU was published in *Journal of Energy Chemistry*.

It reported a facile and efficient strategy to modulate the molecular orbital energies, charge transport capacities, and spin electron densities of the active units in covalent organic frameworks (COFs) by regulating the conjugated unit size to optimize the redox activity and stability of the organic radicals. COFs based on different imide conjugated units exhibit tunable discharge voltages, rate performance, and cycling stabilities. Detailed characterizations and theoretical calculation reveal that imide radicals are important active intermediates during the redox processes of these COFs. Specifically, increasing the size of the imide conjugated units could effectively delocalize the radical electrons and improve the stability of the COFs electrodes. This study offers an effective strategy to modulate the redox chemistry of organic materials for electrochemical energy storage.

More information: Shuai Gu et al, Regulating the radical intermediates by conjugated units in covalent organic frameworks for optimized lithium ion storage, *Journal of Energy Chemistry* (2022). DOI: 10.1016/j.jechem.2022.01.005

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