Covalent Organic Framework: Two-dimensional Crystalline Organic Polymers for Energy Applications

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Our recent research focuses on developing new class of crystalline organic polymers- "Covalent Organic Frameworks (COFs)". These are cross-linked polymers constructed from small building units rich in aromatic groups. Such construct enable them to order by π-π stacking and thereby produces high degree of crystallinity. The vital features of this material are their tunable modular structure, inherent porosity (micro and/or mesoporous) and high surface area. Access to their structures from powder X-ray diffraction and atomic-level modelling enables a 'by-design' development. Recently, we demonstrated their use as support for nanoparticles of $Ni(OH)_2$ and Ni_3N, $Co/Co(OH)_2$ and thus formed composites showed exceptional electrocatalytic activity towards Oxygen Evolution Reaction (OER) from water, catalytic activity for small molecule organic transformation. Very recently, we have investigated their use as anodes in Li-ion batteries and as White Light Emitting Organic Material. Here, we briefly showcase some of these findings.

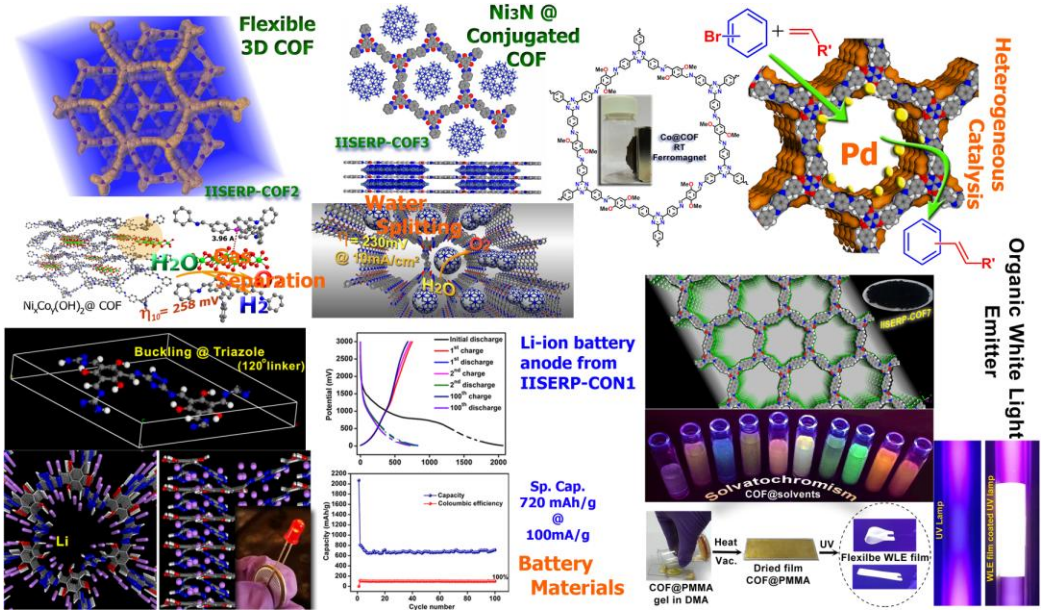

Figure 1. IISERP-COF materials in diverse applications.

Relevant references: Haldar et al. Anthracene-Resorcinol Derived Covalent Organic Framework as Flexible White Light Emitter, *J. Am. Chem. Soc.*, 140: 13367−13374 (2018); Haldar et al. High and Reversible Lithium Ion Storage in Self-Exfoliated Triazole-Triformyl Phloroglucinol-Based Covalent Organic Nanosheets, *Adv. Energy Mater.*, 7, 1702170. Mullangi, et al. Low-overpotential Electrocatalytic Water Splitting with Noble-Metal-Free Nanoparticles Supported in a sp^3 N-rich Flexible COF, *Adv. Energy Mater.*, 6: 1600110.