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INO-OR-019. Chiral Nickel(II)-based Metal-Hydroxide Organic Frameworks (MHOFs) as Spin-selective Catalysts of Oxygen Evolution Reaction

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Spin-polarized currents can reduce the overpotential required for the Oxygen Evolution Reaction (OER), which strongly limits the overall efficiency of the Electrochemical Water Splitting process (EWS).1 Thanks to the Chiral Induced Spin Selectivity (CISS) effect,2 chiral materials can create spin-polarized currents in the absence of external magnetic fields, promoting the formation of ground state O2 (S = 1) while eliminating by-products with S = 0 (e.g., H2O2). State-of-the-art catalysts for EWS are based on expensive and polluting noble metals like Pt and Ir. However, Metal Organic Frameworks (MOFs) containing first-row transition metals, including layered Metal-Hydroxide Organic Frameworks (MHOFs, see Fig. 1), are attracting increasing interest3,4 due to their high surface area and porosity, low cost, “green” character, and tunability by chemical design. Since the use of CISS-active chiral MOFs (or MHOFs) as enhanced electrocatalysts for EWS is still an unexplored field, we synthesized a family of nanostructured chiral (Ni-C) and achiral (Ni-A) MHOFs based on Ni2+ and dicarboxylic ligands (Fig. 1), with low (1), intermediate (2) or high (3) crystallinity. The catalytic activity is found to increase with increasing crystallinity and Brunauer–Emmett–Teller (BET) surface area. More importantly, the current densities are systematically higher for the chiral samples than for the achiral ones (Fig. 1), confirming that chirality is a viable strategy to design efficient catalysts for EWS and OER.

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