

Electrocatalytic properties of cobalt phosphides and pyrophosphates derived from phosphonate-based-MOFs

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As a class of coordination polymers (CPs), metal phosphonates (MPs) are constructed by coordination bonds connecting metal sites and phosphonate (RPO_3^{2-}) ligands, where the metal sites are dispersed uniformly at the atomic level. This feature facilitates the construction of metal-phosphorous-based/nano-carbon composites by one-step pyrolysis, making them very attractive precursors of Non-Precious Metal Electrocatalysts (NPMCs) [1, 2]

In this work, we report the synthesis, characterization and electrochemical properties of three cobalt(II) coordination polymers derived from the N,N-bis(phosphonomethyl)glycine (BPMGLY), $\text{Co}(\text{C}_4\text{H}_9\text{O}_8\text{NP}_2 \cdot n\text{H}_2\text{O})$ ($n=2-4$). These MPs, with different frameworks according to the crystallographic data, are used as precursors of new NPMCs by pyrolytic treatment under 5% H_2/Ar at different temperatures. The electrochemical behavior of the resulting compounds, mainly crystalline cobalt pyrophosphates and/or phosphides, is fully investigated regarding to the Oxygen Evolution and Reduction Reactions (OER and ORR, respectively) as well as Hydrogen Evolution Reaction (HER). In general, cobalt phosphides (CoP) derived from compound Co-BPMGLY-I ($n=4$), displayed better performances for the HER with an overpotential of 156 mV.

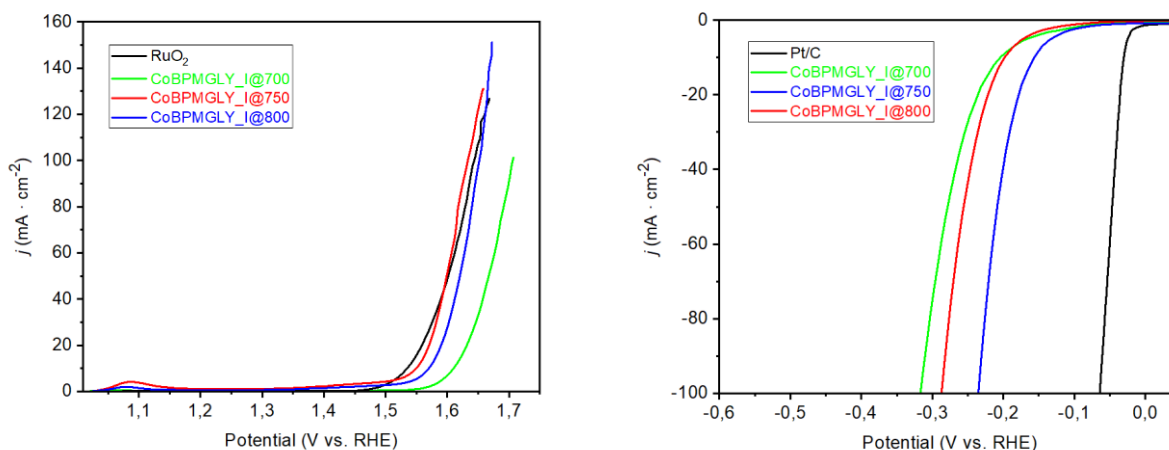


Fig. 1 LSV curves of selected materials for OER in 1.0 M KOH (left) and for HER in 0.5 M H₂SO₄ (right).

1. Wu, J.; Wang, D.; Wan, S.; Liu, H.; Wang, C.; Wang, X. *Small* 16 (2020) 1900550.
2. Zhang, R.; El-Rafaei, S.M.; Russo, P.A.; Pinna, N. J. *Nanoparticle Res.* 20 (2018) 146.

Acknowledgments: This work was funded by PID2019-110249RB-I00 (MICIU/AEI, Spain) and PY20-00416 (Junta de Andalucía, Spain/FEDER) research projects. A.V.C. thanks MICIU for PRE2020-094459 student grant; M.B.G. thanks PAIDI2020-DOC_00272 research grant (Junta de Andalucía, Spain) and R.M.P.C. thanks University of Malaga under Plan Propio de Investigación for financial support.