Zeolitic Imidazolate Frameworks as Template for the Obtention of Nickel and Manganese Cobaltites Applied as Electrocatalyst for Oxygen Evolution Reaction

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Oxygen Evolution Reaction (OER) is the anodic half-reaction in the water electrolysis, using to produce hydrogen gas (H_2), considered a promising clean and renewable energy source [1]. Due to the multistep electron transfer, OER shows high overpotential, and electrocatalyst are need [1,2]. Zeolitic Imidazolate Frameworks (ZIF) and their derivatives like cobalt oxide nanoparticles have been used as electrocatalyst in OER with high performance [2]. Thus, this work reports the use of ZIF-67 (cobalt 2-methylimidazolate) as template to obtain Ni and Mn cobaltites, applied as OER catalysts. Bimetallic cobaltites were obtained via impregnation of ZIF-67 with the respective metal ion in methanol, followed by calcination in air at 350ºC. Materials were characterized by FT-IR and Raman spectroscopy, TGA, XRD with Rietveld refinement, XPS, TEM and SEM microscopy. XRD data indicate the formation of $NiCo_2O_4$ and $Mn_{0.4}Co_{2.6}O_4$ with spinel structure, and particles size 15.8 nm and 28.7 nm, respectively. SEM and TEM images shows the formation of porous hollows morphologies. XPS data indicates the presence of Co^{3+}, $Mn^{3+/4+}$ and Ni^{3+} ions on the surface of the materials, and also high presence of oxygen vacancies, which boots the electrocatalytic activity. Catalytic performances were evaluated using electrochemical measurements (LSV, CV, impedance spectroscopy and chronopotentiometry) in alkaline medium. Overpotential to produce a current density of 10 mA cm^{-2} were 341 mV and 355 mV, respectively for $NiCo_2O_4$ and $Mn_{0.4}Co_{2.6}O_4$. These results are superior to several materials highlighted in the literature, being in the classification of excellent electrocatalysts [3].

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