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Cu(II) coordination polymer for application in electrocatalysis of water oxidation reaction

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The production of clean energy is one of the most important scientific challenges of this century, as most of the global energy is supplied by fossil fuels. To reduce the environmental impacts caused by non-renewable energy sources, green hydrogen produced by clean energy has being pursued. Artificial photosynthesis is a promising alternative, as it was designed to use solar energy with the aim of splitting H_2O into oxygen and hydrogen molecules[1]. Electrochemical systems developed to make the water oxidation half-reaction more efficient are essential for the production of H_2. To address this point, electrocatalysts have been investigated to reduce the kinetic barrier and increase the efficiency for the water oxidation reaction. This work describes a heterometallic coordination network (CNs) composed of copper(II) and lithium(I) ions, with the 2-picolinic acid as ligand for application as an electrocatalyst for the water oxidation reaction. Coordination polymers are examples of CNs formed from the self-assembly of a variety of metal ions as connectors and ligands as linkers. The chemistry of coordination polymers is of great interest due to their structural diversity and unique chemical and physical properties in the solid state, which make them potential candidates for catalytic activity[2]. X-ray crystallographic structure revealed the formation of one-dimensional CN. The electrochemical tests were carried out in phosphate buffer at different pHs to investigate the proton transfer coupled electron transfer. Promising overpotentials were obtained in acid pH with an onset overpotential of 158 mV at current density of 0.2 mA cm^{-2} in pH 2, a different behavior from other complexes of Cu(II) reported in the literature that are more active under alkaline pH. The anodic peaks present a potential shift as pH increases, indicating the occurrence of proton transfer coupled to electron transfer. The scan rate variation studies revealed an apparent first-order rate constant of 0.22 s^{-1} observed in pH 2 and 0.09 s^{-1} in pH 12 for the OER electron transfer.

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