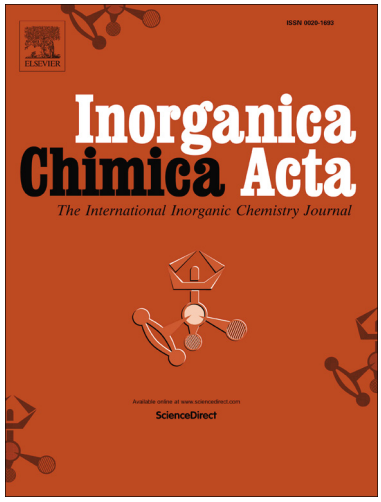

Research paper

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Electrocatalytic Hydrogen Evolution Reaction with a Supramolecular Cobalt(II)phthalocyanine Carrying Four Cobaloxime Moieties

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Abstract

A supramolecular cobalt phthalocyanine (***CoPc***) bearing four redox active cobaloxime (***CoDMG***) substituents ((***CoDMG)$_4$-CoPc***) was synthesized and electrochemically characterized in order to determine its functionalities for practical usages as effective electrocatalysts. Voltammetric analyses of ***CoDMG***, ***CoPc***, and (***CoDMG)$_4$-CoPc*** indicated redox activity of each compounds and supported substitution of ***CoPc*** with ***CoDMG***. (***CoDMG)$_4$-CoPc*** showed three CoPc based reduction processes and two ***CoDMG*** based reduction processes. While ***CoDMG*** showed two reduction and one oxidation processes, ***CoPc*** illustrated three reduction and two oxidation processes. Binding of ***CoDMG*** to ***CoPc*** increased the reduction processes to five. Multi-electron and metal and/or ring based redox processes showed worthy of the (***CoDMG)$_4$-CoPc*** for using as an electrocatalyst. Shifting of the proton reduction reaction toward the positive potentials indicated electrocatalytic activities of the complexes for the hydrogen evolution reaction (*HER*). Among ***CoDMG***, ***CoPc***, and (***CoDMG)$_4$-CoPc,*** modified glassy carbon electrode with (***CoDMG)$_4$-CoPc*** illustrated the highest electrocatalytic activity and it decreased the over-potential of the bare electrode about 360 mV and increased the current density of the electrode about 10 fold.

Keywords: Supramolecule, Electrocatalyst, Hydrogen evolution reaction, Phthalocyanine

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