Four-Electron Reduction of Oxygen Electrocatalyzed by a Mixture of Porphyrin Complexes onto Glassy Carbon Electrode

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In this work a new composite electrode for the electrocatalytic reduction of oxygen (ORR) is presented. For this purpose, glassy carbon electrodes (GC) were modified with Co^{II} and Fe^{III} octaethylporphyrins. The system that presents the highest electrocatalytic activity towards ORR is GC modified with a mixture of both octaethylporphyrins in 1:1 volume proportion (GC Co-Fe 1:1) over the GC electrodes modified with Co^{II} and Fe^{III} octaethylporphyrins separately. This modified electrode can reduce O₂ through two reduction processes (four electrons each), by the generation of H₂O as final product, in two active sites of different chemical nature. All the electrodic systems were morphologically characterized by atomic-force microscopy (AFM) and electrically characterized by electrochemical impedance spectroscopy (EIS). It was found that the electroactive system (GC Co-Fe 1:1) presents high differences on its surface and performs the lowest charge transfer resistance (*R*_{ct}) in comparison to the rest of the modified systems and GC itself.

Keywords: Dioxygen reduction, Modified electrode, porphyrin complex mixtures, Electrocatalysis, Synergic effect

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