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Carbon materials modified with cobalt and vanadium phthalocyanines applied to the electrogeneration of hydrogen peroxide in alkaline media

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Carbon-based materials are promising electrocatalysts of oxygen reduction reaction (ORR) to hydrogen peroxide (H_2O_2) because their oxygenated functional groups favor the H_2O_2 pathway [1-2]. However, ORR on carbon materials starts at highly negative potential requiring their modification with more electroactive ones like metallic phthalocyanines. In this work, carbon black Printex-L6 (PL6C) and graphene oxide (GO) obtained by electrochemical exfoliation of graphite were modified with cobalt (CoPc) and vanadium (VPc) phthalocyanines and applied as electrocatalysts for ORR. PL6C is an amorphous material formed by nanometric particles while the GO is a few layers graphene-based material with low density of defects and composed by sheets of large lateral size (in the range of µm). The electrocatalysts were characterized by Scanning Electron Microscopy, Raman Spectroscopy, X-ray Diffraction and Fourier-Transform Infrared Spectroscopy. The electrocatalytic activity in alkaline solution was evaluated by linear sweep voltammetry. The results showed that PL6C and GO unmodified promote H_2O_2 formation, however, GO exhibits higher current density values and greater electrocatalytic activity compared to PL6C. The modification of both PL6C and GO with CoPc and VPc increased the current density and electrocatalytic activity. However, the best performance was found with GO modified with CoPc, where a current density value of -3 mA/cm^2 was obtained with shift of potential 100 mV more positive. These results suggest different interactions between the carbon matrices and the modifiers which influence in the ORR performance, leading to new insights on hybrids electrocatalysts.

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References
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