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Layered double hydroxide materials coated carbon electrode: New challenge to future electrochemical power devices

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Layered double hydroxides (LDHs) have been widely used in the past years due to their unique physicochemical properties and promising applications in electroanalytical chemistry. The present paper focus exclusively on magnesium-aluminum and zinc-aluminum layered double hydroxides (MgAl & ZnAl LDHs) in order to investigate the property and structure of active cation sites located within the layer structure. The MgAl and ZnAl LDH nanosheets were prepared by the constant pH co-precipitation method and uniformly supported on carbon-based electrode materials to fabricate an LDH electrode. Characterization by powder X-ray diffraction, Fourier transform infrared spectroscopy, scanning electron microscopy and transmission electron microscopy revealed the LDH form and well-crystallized materials. Wetting surface properties (hydrophilicity and hydrophobicity) of both prepared LDHs were recorded by contact angle measurement showed hydrophilic character and basic property. The electrochemical performance of these hybrid materials was investigated by mainly cyclic voltammetry, electrochemical impedance spectroscopy and chronoamperometry techniques to identify the oxidation/reduction processes at the electrode/electrolyte interface and the effect of the divalent metal cations in total reactivity. The hierarchy of the modified electrode proves that the electronic conductivity of the bulk material is considerably dependent on the divalent cation and affects the limiting parameter of the overall redox process. However, MgAl LDH shows better performance than ZnAl LDH, due to the presence of magnesium cations in the layers. Following the structural, morphological and electrochemical behavior studies of both synthesized LDHs, the prepared LDH modified electrodes were tested through microbial fuel cell configuration, revealing a remarkable, potential new pathway for high-performance and cost-effective electrode use in electrochemical power devices.

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Naturally occurring exudates gums as eco-friendly inhibitors for mild steel corrosion in acidic medium

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The corrosion inhibition potentials of gum exudates from Daniella oliveri (DO) and *Commiphora africana* (CA) for the corrosion of mild steel in H_2SO_4 have been studied using weight loss and thermometric methods at 303 and 333K. Results show that the exudates gums actually reduced the rates of corrosion of mild steel. Increase in the concentrations of the exudates gums increased their percentage inhibition efficiencies. Corrosion rate was found to increase with increase in temperature in the presence and absence of the gum exudates, though the corrosion rate was slower in the presence of the exudates gums. Both DO and CA exudates gums were found to obey Temkin and Langmuir adsorption models at all concentrations and temperatures studied. Physical adsorption mechanism was proposed from the adsorption parameters. Kinetic and thermodynamic parameters revealed that the adsorption process is spontaneous, exothermic and no significant difference was found between the inhibition efficiencies of DO and CA.

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