World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:11, No:08, 2017

Electrochemical/Electro-Catalytic Applications of Novel Alcohol Substituted Metallophthalocyanines

Authors : Ipek Gunay, Efe B. Orman, Metin Ozer, Bekir Salih, Ali R. Ozkaya

Abstract : Phthalocyanines with macrocyclic ring containing at least three heteroatoms have nine or more membered structures. Metal-free phthalocyanines react with metal salts to obtain chelate complexes. This is one of the most important features of metal-free phthalocyanine as ligand structure. Although phthalocyanines have very similar properties with porphyrins, they have some advantages such as lower cost, easy to prepare, and chemical and thermal stability. It's known that Pc compounds have shown one-electron metal-and/or ligand-based reversible or quasi-reversible reduction and oxidation processes. The redox properties of phthalocyanines are critically related to the desirable properties of these compounds in their technological applications. Thus, Pc complexes have also been receiving increasing interest in the area of fuel cells due to their high electrocatalytic activity in dioxygen reduction and fuel cell applications. In this study, novel phthalocyanine complexes coordinated with Fe(II) and Co (II) to be used as catalyst were synthesized. Aiming this goal, a new nitrile ligand was synthesized starting from 4-hydroxy-3,5-dimethoxy benzyl alcohol and 4-nitrophthalonitrile in the presence of K2CO3 as catalyst. After the isolation of the new type of nitrile and metal complexes, the characterization of mentioned compounds was achieved by IR, H-NMR and UV-vis methods. In addition, the electrochemical behaviour of Pc complexes was identified by cyclic voltammetry, square wave voltammetry and in situ spectroelectrochemical measurements. Furthermore, the catalytic performances of Pc complexes for oxygen reduction were tested by dynamic voltammetry measurements, carried out by the combined system of rotating ring-disk electrode and potentiostat, in a medium similar to fuel-cell working conditions.

Keywords : phthalocyanine, electrocatalysis, electrochemistry, in-situ spectroelectrochemistry
Conference Title : ICPESE 2017 : International Conference on Power and Energy Systems Engineering
Conference Location : Paris, France
Conference Dates : August 28-29, 2017