Synthesis and characterization of bimetallic complexes, $[Co(en)_3][Dy(edta)(OH_2)]_2$, $[Fe(en)_3][Dy(edta)(OH_2)]_3$ and $[Ni(en)_3][Dy(edta)(OH_2)]_2 \cdot H_2O$, and their electrocatalytic activity for reduction of H^+; Preparation, characterization and magnetic properties of mixed metal oxides nanoparticles, $Co_3O_4 \cdot Dy_2O_3$, $Fe_2O_3 \cdot Dy_2O_3$ and $NiO \cdot Dy_2O_3$, and their electrocatalytic activity for reduction of CO_2 to CO

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Abstract

In this thesis, three bimetallic complexes of Dy(III) with Co(II), Fe(III) or Ni(II), $[Co(en)_3][Dy(edta)(OH_2)]_2$, $[Fe(en)_3][Dy(edta)(OH_2)]_3$ and $[Ni(en)_3][Dy(edta)(OH_2)]_2 \cdot H_2O$, (where en= ethylenediamine and $edta^{4-}$= ethylenediaminetetraacetato), were synthesized and characterized by elemental analysis, FT-IR, UV-Vis and TGA/DTA techniques. The electrocatalytic activity of the bimetallic complexes for reduction of H^+ was investigated by cyclic voltammetry in sulfuric acid solution.

The bimetallic complexes were used for preparation of three mixed metal oxides nanoparticles, $Co_3O_4 \cdot Dy_2O_3$, $Fe_2O_3 \cdot Dy_2O_3$ and $NiO \cdot Dy_2O_3$, using calcination method at three different temperatures (500,600 and 800 ˚C). The nanoparticles were characterized by FT-IR, UV-Vis, FE-SEM and XRD. Their particle size is in the range of 10-40 nm. The electrocatalytic activity of the nanoparticles for electroreduction of CO_2 to CO was also studied by cyclic voltammetry in CH_3CN. In addition, the magnetic property of the nanoparticles was investigated by superconductive quantum interface devise (SQUID). The result show a paramagnetic behaviour for three nanoparticles.

Key words:

Mixed metal oxides nanoparticles, Dy(III) complex, Co(II) complex, Fe(III) complex, Ni(II) complex, Cyclic voltammetry, Electrocatalytic activity, Reduction of CO_2, Magnetic properties