Synthesis of Dy_2O_3 nanoparticles from a new precursor and their catalytic activity for electrochemical CO_2 reduction

Hassan Hadadzadeh [a*], Mohammad Taghi Behnamfar [a], Fatemeh Davar

[a] *Department of Chemistry, Isfahan University of Technology, Isfahan 84156-83111, Iran (e-mail: hadad@cc.iut.ac.ir).*

Carbon dioxide (CO_2) is the primary greenhouse gas emitted through human activities. It is the main cause of global warming in recent years. Hence the conversion of carbon dioxide into useful products is an important objective of the research [1-3]. In this report, the mononuclear Dy(III) complex, $[Dy(PQ)_3(DMF)_2(H_2O)_2]Cl_3$, where PQ is 9,10-phenanthrenequinone, has been prepared under reflux for 20 h in DMF. The Dy complex has been characterized by elemental analysis, spectroscopic methods (UV–Vis, FT–IR and solid state fluorescence), thermogravimetric analysis and X-ray diffraction analysis. Dy_2O_3 nanoparticles were prepared by the calcination of Dy complex precipitates in air at different temperatures up to 700 °C for 2 h. The calcinations temperature was the key parameters which were changed for more investigation. The products were characterized by various methods such as FT–IR, X-ray diffraction analysis and field-emission scanning electron microscopy (FE–SEM). The electrochemical studies of Dy complex and Dy_2O_3 nanoparticles were performed in acetonitrile. The voltammograms in the absence and presence of carbon dioxide indicates that the Dy_2O_3 nanoparticles can catalyze the electrochemical reduction of CO_2.

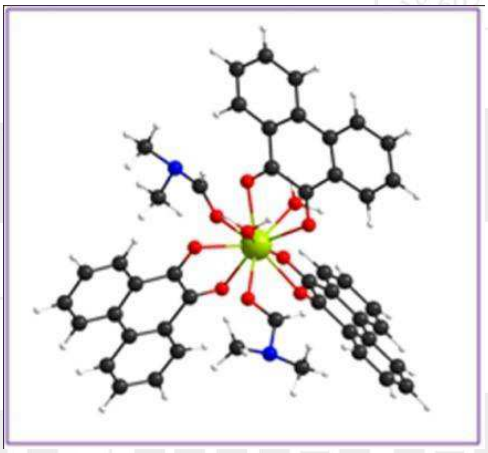

Fig. 1. The optimized structure of $[M(PQ)_3(DMF)_2(H_2O)_2]Cl_3$.

References:

[1] T. Mizukawa, K. Tsuge, H. Nakajima, K. Tanaka, *Angew. Chem. Int. Ed.* 38 (1999) 362.

[2] D.T. Whipple, P.J.A. Kenis, *J. Phys. Chem. Lett.* 24 (2010) 3451.

[3] L. Sun, G.K. Ramesha, P.V. Kamat, J.F. Brennecke, *Langmuir* 30 (2014) 6302.