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R.M. Abdel Hameed, Shymaa S. Medany

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Influence of support material on the electrocatalytic activity of nickel oxide nanoparticles for urea electro-oxidation reaction

R.M. Abdel Hameed*, Shymaa S. Medany

Chemistry Department, Faculty of Science, Cairo University, Giza, Egypt

Abstract

Nickel oxide nanoparticles were deposited on different carbon supports including activated Vulcan XC-72R carbon black (NiO/AC), multi-walled carbon nanotubes (NiO/MWCNTs), graphene (NiO/Gr) and graphite (NiO/Gt) through precipitation step followed by calcination at 400°C. To determine the crystalline structure and morphology of prepared electrocatalysts, X-ray diffraction (XRD) and transmission electron microscopy (TEM) were employed. The electrocatalytic activity of NiO/carbon support electrocatalysts was investigated towards urea electro-oxidation reaction in NaOH solution using cyclic voltammetry, chronoamperometry and electrochemical impedance spectroscopy. Urea oxidation peak current density was increased in the following order: NiO/AC < NiO/MWCNTs < NiO/Gr < NiO/Gt. Chronoamperometry test also showed an increased steady state oxidation current density for NiO/Gt in comparison to other electrocatalysts. The increased activity and stability of NiO/Gt electrocatalyst encourage the application of graphite as an efficient and cost-saving support to carry metal nanoparticles for urea electro-oxidation reaction.

Keywords

Nickel oxide; urea; electro-oxidation; alkaline medium; electrocatalyst; carbon support.

Corresponding author:

E-mail: randa311eg@yahoo.com (R.M. Abdel Hameed).

Telephone: +201145565646.

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