Nickel Nanoparticles-embedded Carbon Particle Fabrication by Solution Plasma in Waste Vegetable Oil

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Solution plasma is a unique method which is the direct discharge process in solution. It is one of the promising techniques for various applications, including metallic/non-metallic nanomaterial syntheses, organic compound decompositions as well as microorganism removals. In term of nanomaterials, solution plasma has been utilized to produce carbon nanoparticles and metallic-carbon nanoparticle systems. The main purpose of this study is to synthesize nickel nanoparticles embedded in carbon particles by solution plasma within a one-step process using waste vegetable oil as carbon source precursor. The experimental setup was simply done by connecting a bipolar-pulsed power generator to the nickel electrodes that were submerged in waste vegetable oil. The black powders of nickel nanoparticles embedded carbon particles (NiNPs/Carbon) were successfully obtained after discharging for 90 min. The morphology of the synthesized NiNPs/Carbon investigated by scanning electron microscope (SEM) exhibited the good dispersion of NiNPs in carbon-particle matrix. The X-ray diffraction clearly showed the co-existence of crystalline Ni nanostructures and amorphous carbon. The crystallite size of NiNPs calculated by Scherrer equation through the Ni (111) diffraction plane was found to be 64 nm. In addition, the catalytic activity of NiNPs/Carbon was measured by cyclic voltammetry (CV) in acid solution. It was found that NiNP/Carbon did not significantly provide the catalytic activity in acid solution. Although this work might not be successful for catalytic enhancement in fuel cell application, it might be applicable to other approaches, such as oxidation of CO conversion and cyclization of organic compound.

Keywords: Ni/Carbon nanoparticle, Solution plasma, Catalyst, Waste vegetable oil

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