Electron Microscopy Investigation of Nanocomposites Between Metal/alloy and N-rGO for Renewable Energy Applications

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Keywords: Electron Microscopy; Nanocomposites; Fuel cells; Catalysts; Anode; Lithium-ion Battery.

Metal/alloy nanocomposites with nitrogen doped reduced graphene oxide (N-rGO) has been studied and reported as efficient catalysts for fuel cells and as high energy density anode for next generation lithium-ion battery. To confirm the microstructure and morphology of the prepared nanocomposites, electron microscopy techniques, x-ray diffraction are the main tools. Platinum based catalysts has long been known as the most effective catalysts for many applications. In this research, Pt alloys, Pd alloys, and non-platinum alloys nanoparticles on N-rGO catalysts were prepared by methods including $NaBH_4$ reduction, microwave assisted, and polyol process. N-rGO was prepared using the well-known modified Hummer method followed by heat treatment under N_2 gas atmosphere and finally heat treated with nitrogen source. Raman spectroscopy, and x-ray photoelectron spectroscopy results confirmed the formation of multisheet graphene and nitrogen functional group on graphene surface. For lithium-ion battery application, silicon germanium and tin nanoparticles were composited with N-rGO with difference ratios. Nanoparticles of metals or alloys were observed highly distributed on N-rGO.