Synthesis, Microstructure and Electrical Properties of NiCo₂O₄/rGO Composites as Pseudocapacitive Electrode for Supercapacitors

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Pseudocapacitive type supercapacitor electrode material based on nanocomposites has been made from a mixture of NiO nanoparticles, Co₃O₄ nanoparticles, and reduced rGO through coprecipitation and hydrothermal methods with calcination process at 900°C with variations in the composition of NiCo₂O₄/rGO nanocomposites at a mass ratio of nickel: cobalt: rGO, namely 2:2:2, 2:3:2, 3:2:2, 3:0:3, 0:3:3, 0:10:0 and 10:0:0. Sampling was carried out in two steps. The first step was the synthesis of NiO and Co₃O₄ nanoparticles using NiS·5H₂O and Co₂SO₄·7H₂O precursors based on the coprecipitation method and reduced rGO derived from graphite oxide (pencil stick) using a modified hummer method. The second stage is mixing NiO, Co₃O₄, and rGO nanoparticles using coprecipitation and hydrothermal methods to form NiCo₂O₄/rGO nanocomposites which are then characterized including: physical properties with SEM, BET, and XRD, chemical properties with FTIR, thermal properties with TG/DTA, and electrical properties with CV meter. The characterization results showed that the most optimum composition was NiCo₂O₄/rGO nanocomposite on S2 with a mass ratio of 2:3:2 producing a hexahedron micrograph image with a spinel crystal structure with a crystalline diameter of 0.454 nm composed of the main group -OH and C=C with a wave number of 3448.51 cm⁻¹, 1627.77 cm⁻¹, crystallization point 468°C, mass decomposition 63.84%, specific surface area 12.75 m²/g, average pore radius 9.534 nm and pore volume 0.06404 cm³/g with its electrical performance namely electrical conductivity of 6.08 S/m and specific capacitance of 289.93 F/g which was applied as electrode candidates for pseudocapacitor type supercapacitor.

Keywords: Nanocomposite, Nickel Cobaltit (NiCo₂O₄), Pseudocapacitor, Reduced Graphene Oxide (rGO), Supercapacitor Electrodes

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