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Área: INO

Synthesis, Characterization and Application of Nanocomposites based on Graphene and Ni-Co Nanoparticles for electrochemical applications

Geovani Gilz (PG)[1], Eduardo Guilherme Cividini Neiva (PQ)[1].
ggilz@furb.br; eneiva@furb.br
[1]Departamento de Química, FURB.
Palavras-Chave: *Nanoparticles, Nickel, Cobalt, Graphene, Batteries.*

Highlights

- High surface area, electrically conductive, thermally conductive;
- Unique properties;
- High surface area;
- CFC and hexagonal crystalline phases;
- Applications in batteries and sensors;

Abstract

Nickel nanoparticles have gained notoriety in several fields due to their unique properties, which differ significantly from those of macroscopic materials. This distinction is attributed to the high proportion of surface atoms in the nanoparticles, which have unsaturated bonds and confer unique characteristics to these materials. Nickel has two main crystalline phases: face-centered cubic (fcc) and hexagonal (hex). While the fcc phase is thermodynamically stable, the hexagonal phase is metastable. In this work, we present a new synthesis route where, in addition to nickel, GO and cobalt were added. Ni hex nanoparticles were obtained through the modified polyol method, using PVP as a passivating agent, and pyrolyzed at 300 °C for one hour in an inert N2 atmosphere. Through the XRD test, it was possible to identify the formation of Ni hex after the pyrolysis process of the material, in the compounds of rGONi, rGONiCo 1 - 0.1, and rGONiCo 1 - 0.5. For the material with a 1:1 ratio, the formation of the metastable phase could not be observed, due to interference from cobalt. The materials performed well as capacitors even with the presence of PVP, which forms a kind of blockade in the oxidation and reduction processes of the material. Electrochemical analyses were performed on all non-pyrolyzed materials, as well as on the pyrolyzed materials, and the best performing composite was the binary compound with rGONi. The electrochemical analyses showed that without the formation of the metastable Ni phase, the material with a 1:1 ratio performed well compared to the other composites with a lower ratio, even without the metastable phase formation.

Figure 1: *XRD of pyrolyzed materials*

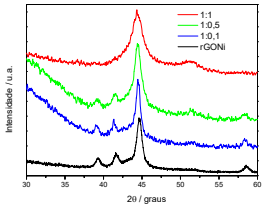


Figure 2: *current capacity graph of pyrolyzed materials*

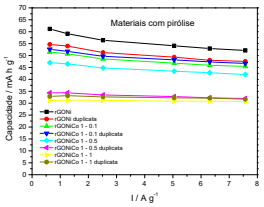


Figure 3: *capacity graph by current of materials without pyrolysis*

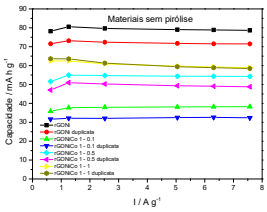
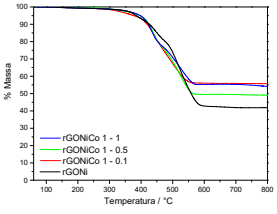


Figure 4: *TGA of pyrolyzed samples*



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