

SYNTHESIS AND CHARACTERIZATION OF AU-NI NANOPARTICLES

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Abstract

AuNi nanoparticles (NPs) were prepared from HAuCl_4 and acetylacetonate $\text{Ni}(\text{acac})_2$ by the solvothermal route of wet synthesis in oleylamine at 230°C . The hexane suspension and the dry nanopowder of the Au-Ni nanoparticles were prepared. Chemical composition of as-synthesized AuNi NPs was obtained using inductively-coupled plasma-optical emission spectrometry (ICP-OES). The optical properties of nanoparticles were monitored using UV-Vis spectrophotometer. The hydrodynamic size of colloid nanoparticles was measured by dynamic light scattering (DLS). Size and shape of metal core of nanoparticles and morphology of aggregates were investigated by electron microscopy (SEM, TEM and HRTEM). Hydrodynamic size of AuNi NPs measured by DLS was compared with the metallic core size obtained by electron microscopy. The thermal properties of AuNi NPs were evaluated by differential scanning calorimetry (DSC) and temperature controlled X-ray diffraction method (t-XRD). The magnetization curves of the AuNi NPs were measured during the heating procedure up to 400°C and cooling to room temperature. The fraction of organic matter was deduced from ICP-OES analysis and compared to TGA mass loss. The morphology of aggregate was observed as well as the phase transformation that undergoes at heating (t-XRD, DSC). The experimentally observed information on AuNi NPs was compared with the predicted phase diagram, which was obtained by CALPHAD approach respecting surface energy of the AuNi alloy.

Keywords: Nanoalloy, phase, transformation, magnetic, CALPHAD

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