1. Preparation and Implementation of CuONanoparticles Reinforcing Phase in 70Ni-30Cu base Composite Material

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Abstract

Nano materials have attractive properties. They have been employed in different fields, such materials engineering, medicine and environment. In this study, CuO nanoparticles were prepared using the nonorganic sol-gel process. Also, the effect of the pH value on the properties of the synthesized CuO nanoparticles was studied by preparing CuO nanoparticles with two different pH values 7 and 11. The prepared CuO nanoparticles were characterized by XRD, SEM, and particle size analyzer. CuO particle average size increased from approximately 10 nm at pH value of 7 to 93 nm at pH value of 11. Also particles changed from a green spherical shape at pH value of 7 to a nearly black colored flakes-shaped particles at a pH value of 11. The prepared CuO nanoparticles (which prepared with pH value of 7) were added to a metal-matrix alloy composed of 70 wt.%Ni and 30wt.%Cu to produce nanocomposites using powder metallurgy technique. 14 samples were prepared; 7 samples at a compaction pressure 60 MPa (1st group) and 7 samples at a compaction pressure of 70 MPa (2nd group). In both groups, CuO nanoparticles addition was up to 3 wt.% of the total matrix weight. To evaluate CuO nanoparticles as a reinforcing phase in composite materials, the prepared nanocomposite samples were examined by different experimental tests. Optical microscope examination results of samples were analysed using ImageJ software. It was concluded that increasing the CuO nanoparticles weight percentage up to 3 wt.% had slightly reduced grains sizes, but significantly reduced size and total number of porosities in both groups. Hardness test results showed 50% improvement in the 2nd group hardness and slight improvement in the 1st group hardness. The 2nd group of samples experienced the highest improvement in the overall characteristics due to increasing sintering time period by an additional 2 hours for the 2nd group.