Preparation of Bi–Fe$_3$O$_4$ nanocomposite through reduction of Bi$_2$O$_3$ with Fe via high-energy ball milling

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Abstract

High-energy ball milling of Bi$_2$O$_3$ and Fe in air and argon atmospheres led to a novel Bi–Fe$_3$O$_4$ nanocomposite. XRD investigation of the as milled powder shows that there are only two phases of Bi and Fe$_3$O$_4$. GTM results show that the reaction is completed after about 2.5 h with no ignition temperature. Mean crystallite sizes of the Bi and Fe$_3$O$_4$ in the composite were 22 and 18 nm, respectively, calculated by Scherrer’s formula. The morphology of the as milled powder was also investigated by a TEM. A two-probe method was used to measure resistivity variation of the composite as a function of temperature, by which a percolation temperature of 229 ± 1°C was obtained.

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