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Effect of annealing temperature on the structural and magnetic properties of Ba-Pb-hexaferrite powders synthesized by sol-gel auto-combustion method

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Abstract

The annealing temperature (T_a) dependent development in phase purity, morphology and magnetic properties of $Ba_xPb_{1-x}Fe_{12}O_{19}$ ($x = 0, 0.2, 0.4, 0.6, 0.8$ and 1) powders synthesized via sol-gel auto-combustion route were studied. The hexagonal phase of $PbFe_{12}O_{19}$ forms directly via solid-state-reaction between $\alpha-Fe_2O_3$ and PbO during annealing of the combustion product at $T_a \sim 900$ °C, but the $BaFe_{12}O_{19}$ phase forms at $T_a \sim 1200$ °C through the formation of $BaFe_2O_4$ and $\alpha-Fe_2O_3$ intermediate-phases at low T_a . The $Ba_xPb_{1-x}Fe_{12}O_{19}$ -phase purity of the sample depends on T_a . For $T_a > 1000$ °C, PbO evaporates from Pb -containing samples. With increasing T_a , growth of hexagonal-shaped sharp-edged particles was observed for Barium-rich samples, however, the sharp-edges dissolve for Lead-rich samples. High saturation magnetization was observed for Ba-rich samples annealed at 1100 °C. For all the studied samples, magnetic coercivity increases with x but decreases with T_a . The magnetic properties of the samples were correlated with its structure, microstructure and grain-size.

Keywords: Ba-Pb hexaferrites; High temperature annealing; Mössbauer spectroscopy; grain size; magnetic coercivity.

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