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Magnetic and dielectric behavior of praseodymium substituted barium hexaferrite

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Abstract: Magnetic and dielectric properties of barium hexaferrite doped with praseodymium at different calcination temperatures have been investigated. Sol gel auto-combustion method was used to synthesize $Ba_{1-x}Pr_xCo_xFe_{12-x}O_{19}$ *(x=0.4)*. Fourier-transform infrared spectroscopy (FTIR), thermo-gravimetry analysis (TGA), X-ray diffraction (XRD), transmission electron microscopy (TEM), vibrating sample magnetometer (VSM) and dielectric spectroscopy have been used to characterize the synthesized M-type hexaferrite. Analysis of FTIR, TGA and XRD results, confirmed the complete formation of M-type hexagonal phase with average crystallite size lying in the range 38 ± 5 nm. VSM analysis revealed the increase of coercivity, retentivity, and saturation magnetization at higher calcination temperature but under same condition decrease in the values of dielectric constant and tangent loss is observed by dielectric spectroscopy. On the basis of obtained results, $Ba_{1-x}Pr_xCo_xFe_{12-x}o_{19}$ *(x=0.4)* calcinated at 800 ^{0}C is being proposed as a harder magnetic material for manufacturing permanent magnets.

Keywords: M-type barium hexaferrite, Sol-gel auto-combustion method, Magnetic properties, Dielectric behavior

1. Introduction

General molecular formula of M-type barium hexaferrite is $BaFe_{12}O_{19}$, which has complex magneto-plumbite structure [1-3]. It is well known for its high coercivity, large saturation magnetization, good mechanical hardness, superior chemical stability and better corrosion resistivity [4-8]. It has been widely used to manufacture permanent magnetic materials, microwave device technology for absorption of electromagnetic waves, magnetic recording media to store a large amount of data in the form of memory devices, speaker, radar communication, etc[4-12]. The magnetic properties of hexagonal magnetic ferrites, like