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The crystal structure and magnetic properties of $Ba_{2-x}Sr_xCo_2Fe_{12}O_{22}$

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We have synthesized the $Ba_{2-x}Sr_xCo_2Fe_{12}O_{22}$ samples (x = 0.1, 0.2, 0.3, 0.4, 0.5) by the solid-state reaction method and investigated their crystalline and magnetic properties by X-ray diffractometer (XRD), Mössbauer spectrometer, vibrating sample magnetometer, and network analyzer. XRD patterns show that all samples are rhombohedral with space group *R-3m*. The lattice constants a_0 and c_0 decrease with Sr substitution due to smaller ion radius of Sr^{2+} (1.27 Å) than that of Ba^{2+} (1.43 Å). The Mössbauer spectroscopy measurements show that the relative area ratios of Fe ion were maintained constant regardless of the Sr concentration. However, average magnetic hyperfine field slightly increased with the Sr concentration. This observation agrees with the fact that the saturation magnetization (M_s) linearly increases due to the increasing super-exchange interaction, originated from the difference in the ionic radius between Ba^{2+} and Sr^{2+}. To investigate its properties at high frequency range, all samples were sintered at 1100 °C, and complex permeability and permittivity were measured by network analyzer between 100 MHz and 4 GHz. For x below 0.3, the initial permeability at 100 MHz increases, at higher values of x, its value decreases. Our study shows that magnetic properties of Sr^{2+} substitution for Ba^{2+} in Y-type hexaferrite as well as low magnetic loss less than 0.1 in 1 GHz band, indicating the potential application of $Ba_{2-x}Sr_xCo_2Fe_{12}O_{22}$ samples for RF and antenna devices in ultra high frequency band. [http://dx.doi.org/10.1063/1.4866892]