

## Magnetic Properties of $\text{Cr}^{3+}$ Substituted $\text{BaFe}_{12}\text{O}_{19}$ Powders Grown by a Sol-gel Method

Chul Sung Kim, Sung Yong An, and Ji Hee Son

Department of Physics, Kookmin University, Seoul 136-702, Korea

Jae-Gwang Lee

Department of Applied Physics, Konkuk University, Chungbuk 380-701, Korea

Hang Nam Oak

Department of Physics, Yonsei University, Seoul 120-749, Korea

**Abstract** —  $\text{Cr}^{3+}$  substituted Ba-hexaferrite was fabricated by a sol-gel method. The crystallographic and magnetic properties of  $\text{BaFe}_{12-x}\text{Cr}_x\text{O}_{19}$  ( $0 \leq x \leq 7$ ) were investigated XRD, Rutherford back-scattering spectrometry, vibrating sample magnetometry and Mössbauer spectroscopy. The crystal structure was found to be magnetoplumbite, typical of M-type hexagonal ferrite. By substituting  $\text{Fe}^{3+}$  in  $\text{BaFe}_{12}\text{O}_{19}$  by  $\text{Cr}^{3+}$ , we have been able to attribute the Mössbauer parameters to the 5 crystallographic sites of the structure. Only the octahedral sublattices were occupied by Cr ions. The isomer shifts indicate that the valence state of the Fe ions was  $\text{Fe}^{3+}$ . The Curie temperatures of  $\text{BaFe}_{12-x}\text{Cr}_x\text{O}_{19}$  decreased linearly increasing Cr-substitution, at a rate of 55 K/Cr atom.

**Index Terms** — Ba-ferrite, sol-gel, Mössbauer spectroscopy, Rutherford back-scattering