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abstracts
BaFe$_{11}$Al$_1$O$_{19}$ powders were prepared by a wet chemical process. Magnetic and structural properties of the powders were characterized with an X-ray diffractometer (XRD), a vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. X-ray diffraction measurements showed that the BaFe$_{11}$Al$_1$O$_{19}$ had a M-type hexagonal structure and lattice constants is decreased from $a_0=5.901$ Å and $c_0=23.243$ Å to $a_0=5.870$ Å and $c_0=23.190$ Å, as compared with BaFe$_{12}$O$_{19}$, which could be understood of Vegard's law. When one substitute Fe$^{3+}$ ions for Al$^{3+}$ ions, the saturation magnetization ($M_s$) is decreased to 44.3 emu/g and coercivity ($H_c$) is increased to 7562 Oe rapidly at room temperature under an applied field of 15 kOe. Mössbauer spectroscopy was performed at various temperatures ranging from 15 to 800 K, and was fitted with five subspectra of Fe sites in the structure ($4f_1$, $2a$, $4f_2$, $12k$, and $2b$) and Curie temperature ($T_c$) determined 700 ± 5 K. With substituted Al$^{3+}$, hyperfine field is decreased and the $2b$ site had a very large quadrupole splitting. The isomer shifts indicate that the valence state of Fe ions is ferric ($Fe^{3+}$).