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# Local Magnetic Properties of Spinel $Cd_{0.9}M_{0.1}Fe_2O_4$(M = Zn, Ni) Investigated by Using External Magnetic Field Mössbauer Spectrometry

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$Cd_{0.9}M_{0.1}Fe_2O_4$ (M = Zn, Ni) ferrites, prepared by using a solid state reaction method, have been studied by using X-ray diffraction and Mössbauer spectroscopy. The lattice constants are determined to be $a_0$ = 8.686 Å for $Cd_{0.9}Zn_{0.1}Fe_2O_4$ and 8.664 Å for $Cd_{0.9}Ni_{0.1}Fe_2O_4$ with a cubic spinel structure. Zero-field Mössbauer spectra of the samples were taken at various temperatures ranging from 4.2 to 295 K. A line broadening arising from the relaxation effect was observed at temperatures below the Néel temperature ($T_N$), which is 18 K for $Cd_{0.9}Zn_{0.1}Fe_2O_4$ and 40 K for $Cd_{0.9}Ni_{0.1}Fe_2O_4$. The magnetic hyperfine fields, obtained by fitting Mössbauer spectra with two magnetic components, of $Cd_{0.9}Zn_{0.1}Fe_2O_4$ and $Cd_{0.9}Ni_{0.1}Fe_2O_4$ were $H_{hf}(A)$ = 461 kOe, $H_{hf}(B)$ = 492 kOe, and $H_{hf}(A)$ = 485 kOe, $H_{hf}(B)$ = 503 kOe, respectively. The isomer shift $\delta$ values at room temperature were 0.24 ~ 0.25 mm/s, indicating that the valence state of Fe ions is ferric in tetrahedral and octahedral coordination. Their magnetic behaviors at low temperatures were also investigated with an external-field Mössbauer spectrometer at 48 kOe and showed localized spin-canting at both $A$ and $B$ sites with the average canting angles of 65° and 54° for $Cd_{0.9}Zn_{0.1}Fe_2O_4$ and of 51° and 43° for $Cd_{0.9}Ni_{0.1}Fe_2O_4$ at 4.2 K.

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