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Improved magnetic properties of Zn-substituted strontium W-type hexaferrites

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Abstract— The Zn^{2+} substitution for the Fe^{2+} site was found to be effective for the improvement of the saturation magnetization (M_s) of strontium W-type hexaferrite ($SrFe_{18}O_{27}$). For this study, polycrystalline $SrFe_{18}O_{27}$ with various Zn-substituents of $SrZn_xFe_{(2-x)}Fe_{16}O_{27}$ ($SrZn_xFe_{(2-x)}W$, $0.0 \leq x \leq 1.5$) were sintered at high temperatures in a reduced oxygen atmosphere of 10^{-3} atm. While pure $SrZn_xFe_{(2-x)}W$-type solid solutions ($0.0 \leq x \leq 1.0$) could be obtained from the samples of x = 0–1.0, the second phase of $ZnFe_2O_4$ was obtained from the sample of x = 1.5. With increasing x up to 1.0, M_s values were monotonously increased and the highest M_s value of 87.7 emu/g was achievable from the sample of x = 1.0 sintered at 1250˚C. In addition, post-annealing heat treatments of samples for oxygenation at 300˚C in pure oxygen gas revealed that oxygen non-stoichiometry increased with increasing the sintering temperature, leading to the increase in M_s, unit cell volume, and electrical conductivity.

Keywords: W-type hexaferrite; low oxygen pressure; Zn^{2+} substitution; oxygen non-stoichiometry; magnetic property; saturation magnetization