

The Effect of Oxygen Annealing on the Magnetic Properties of Strontium W-type Hexagonal Ferrite

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In this report, we examined the role of oxygen vacancy on the magnetic properties of strontium W-type hexaferrite ($\text{SrFe}_{18}\text{O}_{27}$, SrW), which is a ferrimagnetic oxide material that has a hexagonal crystal structure. The SrW samples were obtained by annealing and subsequent furnace-cooling in the PO_2 of 10^{-3} atm. The samples showed different cell volumes and saturation magnetization (M_s) values for different annealing temperatures. The samples annealed at 1300, 1310, and 1315 °C in the PO_2 of 10^{-3} atm, exhibited the M_s values of 78.9, 79.9, and 81.4 emu/g, and cell volumes of 984.32, 985.28, and 986.85 Å³, respectively. The difference in M_s and cell volumes may come from oxygen vacancy of the samples due to low annealing PO_2 , since the oxygen vacancy can cause reduction of Fe^{3+} to Fe^{2+} possessing different magnetic moments and different ionic radius. To verify the origin of the different M_s values, and cell volumes, we tried to oxygenate the samples obtained at the different annealing temperatures (1300, 1310, and 1315 °C) by annealing in air. As a result, the M_s values and cell volumes of the samples decreased during the oxygenation process and the values become similar for the different samples. Detailed analysis of oxygen vacancy in SrW and its effect on magnetic properties will be presented for a discussion.

Keywords : Hexagonal ferrite; oxygen deficiency; oxygen annealing; magnetic property