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Observation on MnO-bearing Wustite

—Synthesis, Properties and Thermal Decomposition—

Norio TASHIMA*

Mixtures of accurately weighed Mn, Fe and Fe_3O_4 powder were pressed and vacuum-sealed in quarty tube, and then heated at 1000°C for 9 hrs followed by quenching into water. The composition was chosen so as to occur the following reaction quantitatively.

$$4y\mathrm{Mn}+\{1-4(x+y)\}\mathrm{Fe}+\mathrm{Fe_3O_4}\rightarrow 4\mathrm{Mn}_y\mathrm{Fe}_{1-(x+y)}\mathrm{O}$$

The specimens thus obtained were found to be one phase (wustite) from both microscopic observation and X-ray diffraction analysis. Chemical composition was corrected by chemical analysis of the quenched samples.

From measurement of electrical conductivity of the quenched samples, it was found that the Néel temperature decreased with the increase of Mn content. Measurement of thermoelectromotive force showed that the electrical conduction of the wustite may be explained by the hopping mechanism of positive holes.

By thermo-magnetic analysis and heat treatments, the nature of thermal decomposition was presumed to be that in heating to 250°C, solubility of Fe and Mn in the wustite is decreased and spinel phase containg Fe and Mn is separated as in the following way.

$$(\mathrm{Mn}\cdot\mathrm{Fe})_{1-x}\mathrm{O}\rightarrow(\mathrm{Mn}\cdot\mathrm{Fe})_{1-y}\mathrm{O}+(\mathrm{MnFe})_3\mathrm{O}_4$$

By heating it up to nearly 400°C, the second step of decomposition rapidly occurs as in the following way.

$$(\mathrm{M}\cdot\mathrm{Fe})_{1-y}\mathrm{O}\rightarrow(\mathrm{Mn}\cdot\mathrm{Fe})_3\mathrm{O}_4+\text{metal (Fe)}.$$

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