The Electrical Conductivity of NiO-System under High Pressure(II)

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Abstract

In the present experiment, these were investigated. (1) The variation of the electric resistance and the activation energy of conductivity of Li-doped NiO with Li concentration at high pressure. (2) The Seebeck coefficient in the temperature range from room temperature to 700 °C. (3) The pressure dependency of the Neel point of NiO were investigated. The Seebeck coefficient was obtained by measuring temperature difference and potential drop fixing two couples of thermocouple on the both ends of a sample under high pressure generated by a piston-cylinder type high pressure apparatus. The electric coefficient was measured by Bridgman-type anvils with radii of 5.64 mm and 10 mm. Temperature dependency of the resistance of $Li_xNi_{1-x}O$ is given by the following expressions,

$$T/R = A_1 \exp(-q_1/kT) \qquad \text{at } T > T^*$$

$$T/R = A_2 \exp(-q_2/kT) \qquad \text{at } T < T^*$$

where T* is nearly Neel temperature. In the range, x 0.02, q_1 q_2, and in the range x 0.02, q_1 q_2.

Fig. 1 shows the pressure variance of q_1 and q_2 of samples at x = 0.01 and x = 0.1. If the result above 30 kb. was extrapolated to the atmospheric pressure, it agreed with the value obtained by the measurement using a single crystal. At the pressure less than 30 kb., however, pressure dependency of q was not linear.

Fig. 2 shows the result of the measurement of the temperature variance of Seebeck coefficient under the high pressure. As all of them had positive thermo-emf $\alpha(\mu V.deg^{-1})$, they were considered to have positive hole conduction. According to Heikes,

$$\alpha = k/e(Q/2kT - \ln C_0/(1 - 2C))$$

where Q is trapping potential, C is hole concentration, and C_0 is concentration of dopant. Therefore, plots of $\alpha(\mu V.deg^{-1})$ vs. 1000/T become linear.