164 - High Temperature *p-type* and *n-type* Thermoelectric Properties of $Pr_{1-x}Sr_xFeO_3$ (0.1≦x≦0.9)

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Abstract

Polycrystalline samples of $Pr_{1-x}Sr_xFeO_3$ (0.1≦x≦0.9) were synthesized using a conventional solid-state reaction method. We investigated crystal structure and bond valence sum at room temperature, and magnetic susceptibility, electrical resistivity, Seebeck coefficient, thermal conductivity, and *ZT* as a function of temperature. The perovskite structures changed from orthorhombic *Pbnm* phases to rhombohedral *R-3c* ones at $x = 0.4$. The temperature dependence of inverse magnetic susceptibilities showed that the spin state of Fe ions consists of intermediate spin (IS) Fe^{3+} ($t_{2g}^4e_g^1$), low spin (LS) Fe^{3+} (t_{2g}^5), and LS Fe^{4+} (t_{2g}^4) ions below $x = 0.4$. On the other hand, the spin state of Fe ions consists of IS Fe^{3+} ($t_{2g}^4e_g^1$) and LS Fe^{4+} (t_{2g}^4) ions above $x = 0.5$. This means that the carrier type for $Pr_{1-x}Sr_xFeO_3$ changes from t_{2g} hole like to e_g electron like behavior. In fact, the samples for x≦0.3 show a large positive Seebeck coefficient over the whole temperature range although Seebeck coefficient of the samples for 0.4≦x≦0.5 decreases with increasing temperature and that of the samples for x≧0.7 show a negative Seebeck coefficient over the whole temperature range. In particular, the samples for $x = 0.1$ and 0.9 exhibited *p*-type and *n*-type thermoelectric properties with relatively high Seebeck coefficient, moderate electrical resistivity and low thermal conductivity, respectively. For example, the sample with $x = 0.1$ showed a power factor of $20\mu Wm^{-1}K^{-2}$ at 850K leading to *ZT* of about 0.024 at this temperature, indicating that perovskite-type Fe oxides are one of the good candidate for high temperature thermoelectric materials.