Improved thermoelectric characteristics of misfit-layered cobaltites \( \text{Ca}_3\text{Co}_4-\frac{x}{2}\text{Fe}_x\text{O}_{9+\delta} \).\(^1\) CHIA-JYI LIU, LI-CHEN HUANG, WEN-CHING HUNG, Department of Physics, National Changhua University of Education, JENG-LUNG CHEN, CHING-LIN CHANG, Department of Physics, Tamkang University — We have measured the electrical resistivity, Seebeck coefficients and thermal conductivity as a function temperature for a new series of oxides \( \text{Ca}_3\text{Co}_4-\frac{x}{2}\text{Fe}_x\text{O}_9 \) (\( x=0, 0.05, 0.1, 0.15, 0.2 \)) prepared by the conventional solid state reaction. Structural parameters were refined with a superspace group of \( \text{X2/m(0b0)s0} \) using powder X-ray diffraction data. With the substitution of \( \text{Fe}^{+2} \) for \( \text{Co}^{+3} \), the resistivity (\( \rho \)) decreases, while the thermoelectric power (\( S \)) also increases simultaneously. In the low temperature regime from 15 K to 60 K, the electrical conductivity follows the Mott’s law of the form \( \exp\left[\frac{T_0}{T-1/4}\right] \), suggesting the variable-range-hopping transport. The thermoelectric power also shows the same transport mechanism in the same temperature regime. The \( x = 0.05 \) sample exhibits a higher power factor value (3.3 \( \mu \text{W/K}^2\text{-cm} \)) than that of undoped \( \text{Ca}_3\text{Co}_4\text{O}_9 \) (1.2 \( \mu \text{W/K}^2\text{-cm} \)) at 300K, indicating the improvement of the thermoelectric characteristics upon Fe substitution for Co.

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