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# Thermoelectric properties and microstructure of modified novel complex cobalt oxides $\text{Sr}_3\text{RECo}_4\text{O}_{10.5}$ (RE = Y and Gd)

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Thermoelectric properties from 300 to 1200 K and microstructure of novel complex cobalt oxides  $\text{Sr}_3\text{RECo}_4\text{O}_{10.5}$  (RE = Y and Gd) have been investigated in terms of Ca and Ga doping at the Sr- and Co-sites, respectively. We found that the sample with RE = Gd shows a significant higher electrical conductivity ( $\sigma$ ) than the RE = Y sample in the high temperature region above 500 K, while the Seebeck coefficient ( $S$ ) of these samples remains almost the same over the whole measured temperature range. With Ga substituting for Co,  $S$  at temperatures above 700 K increases, and its values tend to increase with increasing Ga concentration. The power factor ( $\sigma S^2$ ) of the  $\text{Sr}_3\text{GdCo}_{4-x}\text{Ga}_x\text{O}_{10.5}$  system is significantly enhanced and further improved by the substitution of Ca on the Sr-site due to a simultaneously increase in both  $\sigma$  and  $S$ . At 1150 K, the highest  $\sigma S^2$  value of  $\text{Sr}_2\text{CaGdCo}_{3.9}\text{Ga}_{0.1}\text{O}_{10.5}$  sample attains about  $60 \mu\text{Wm}^{-1}\text{K}^{-2}$ , which is 8 times larger than the  $\text{Sr}_3\text{GdCo}_4\text{O}_{10.5}$  counterpart. Interestingly, microstructure shows a clear evolution of crystalline grains for the Ga and Ca dually doped-sample resulting in a substantial decrease of its porosity.

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