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Thermal Transport Measurements of $LaCoO_3$ and $SrTiO_3$

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Abstract – Thermal conductivity and thermopower measurements have been carried out on $SrTiO_3$ single crystal, these measurements were compared with the obtained for $LaCoO_3$ in bulk form. The Maximum value of thermal conductivity of $SrTiO_3$ (110) and Nb-doped $SrTiO_3$ single crystal were 1.09 and 0.91 W/mK respectively at 300°K; and their thermopower measurements were –5.47 and –41.17 µV/K respectively at 300°K . While the $LaCoO_3$ in bulk have a thermal conductivity with a maximum value of 0.37 W/mK and a thermopower with a maximum value of 620 µV/K. The large value of thermopower in $LaCoO_3$ allows take in account for thermoelectric devices.

Perovskite-type oxides comprising a rare earth ion and a *d* transition metal ion such as lanthanum cobaltite ($LaCoO_3$) are being increasingly applied to the electronic, magnetic materials and energy conversion [1]. The $LaCoO_3$ perovskite receive attention as potential candidate for thermoelectric applications and exhibits unusual spin-state transition. The high temperature stability and isotropic crystal structure of $LaCoO_3$ also offer an advantage in design high temperature thermoelectric devices and eliminates the need of epitaxial growth in preparing thermoelectric elements [2]

In order to prepare these mixed oxides, the oxide-mixing method based on the solid state reaction between the component metal oxides is still utilized because of its lower manufacturing cost and simpler preparation process. However, this method, in general, requires the calcining temperature higher than 1000ºC to eliminate the unreacted oxides and to obtain the final product of a single phase [3].

Recently, complex metal oxides such as heavily electron-doped $SrTiO_3$, have attracted much attention for generating thermoelectric power at high temperatures (1000 K). Besides Nb-doped $SrTiO_3$ exhibits large values of Seebeck coefficient and thermal conductivity among reported *n*-type metal oxides [4].

In the figure 1, $SrTiO_3$ (110) single crystal have a high value of thermal conductivity compared with the Nb-doped $SrTiO_3$, in this sense the doped is a strategy to reduce the thermal conductivity of a crystalline material. It clearly indicates that the perovskites structures $SrTiO_3$ and $LaCoO_3$ type has high potential to become a good thermoelectric material.

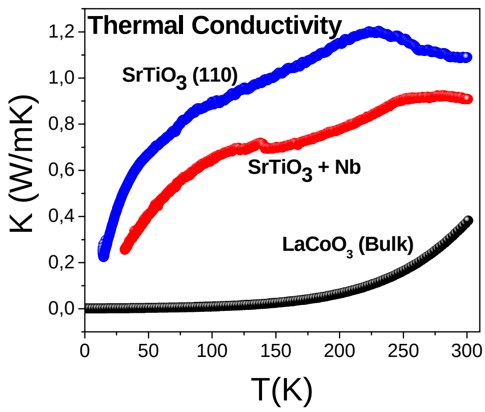

Figure 1 Thermal conductivity measurements of $SrTiO_3$ (Nb- doped, (110)) Single Crystal and $LaCoO_3$ in Bulk form.

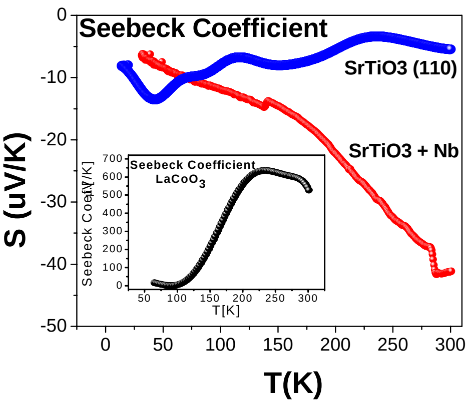

Figure 2 Thermo-power measurements of $SrTiO_3$ (Nb-doped, (110)) single crystal and $LaCoO_3$ in bulk form.

References
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