MSE SEMINAR

March 17, 2017
113 McBryde Hall
3:30 – 4:30 PM
Refreshments at 3:00 PM

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"Effect of lutetium and gallium co-doping on the thermoelectric properties of calcium cobalt oxides"

ABSTRACT

In this work, the effect of Lu^{3+} and Ga^{3+} co-doping on thermoelectric properties of $Ca_3Co_4O_{9+\delta}$ was investigated. The thermoelectric performance of $Ca_3Co_4O_{9+\delta}$ is associated with unique layered structure, which consists of stacks of $[CoO_2]$ conductive layer and $[Ca_2CoO_3]$ insulating layer. Ion doping and different fabrication methods were applied for enhancing the thermoelectric performance of $Ca_3Co_4O_{9+\delta}$. Ca-sites and Co-sites were respectively substituted by Lu^{3+} and Ga^{3+} in the NaCl-type $[Ca_2CoO_3]$ layer. Defect engineered p-type thermoelectric $Ca_3Co_4O_{9+\delta}$ materials were synthesized by spark plasma sintering (SPS) technique. The influence of the sample density on their thermoelectric performance was found to be significant. We show that porous microstructure and doping-induced point defect scattering result in lower thermal conductivity and higher figure of merit (ZT). Thermoelectric performance of $Ca_3Co_4O_{9+\delta}$ is slightly improved by Lu^{3+} and Ga^{3+} co-doping. The maximum ZT value of about 0.12 at 629^{o}C was obtained for the spark plasma sintered $Ca_{2.85}Lu_{0.15}Co_{3.95}Ga_{0.05}O_{9+\delta}$ sample.

BIOSKETCH

Myung-Eun Song is a Ph. D. candidate in Materials Science and Engineering (MSE) at Virginia Tech. He received the B.S. and M.S. degree in MSE from Korea University, 2008 and 2010, respectively. Before he joined Virginia Tech in 2014, he has worked at Kolon Industries, Inc., South Korea for 3 years as a senior research engineer. His research interests are now on magnetoelectric energy harvesting, thermoelectric materials, oxidation resistance coating, and polymer-derived ceramics.