

MSE SEMINAR

November 17, 2017

113 McBryde Hall

3:30 – 4:30 PM

Refreshments at 3:00 PM

Han Byul Kang

Graduate Student

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“Fine Tuning of Thermoelectric Properties on (Zr,Hf)NiSn Half-Heusler Alloys for Thermoelectric Generators”

ABSTRACT

Realistic thermoelectric (TE) generator development has been in the spotlight of energy harvesting society by significant improvements of material performance in the past decade. In order to convert TE materials into real application, great thermal and mechanical stability of the TE materials is highly required as well as high TE performance of materials. In this respect, half-Heusler (HH) alloys are so attractive as high-temperature TE material due to their high figure of merit (zT) along with mechanical and thermal stability. In this work, we systematically studied $MNiSn$ ($M = \text{Hf, Zr}$) based alloys by methodical control of processing parameters from raw materials to sintering conditions in order to fabricate high zT HH alloys, which further lead to the high efficiency thermoelectric generators. We achieved maximum zT of ~ 1.18 at 850 K and average zT of ~ 0.85 in the range of 400 to 850 K through this comprehensive optimization studies. Finally, we developed a single-couple of thermoelectric device using our as-synthesized n- and p-type half-Heusler alloys. The TE generator showed $\sim 7.3\%$ of conversion efficiency with ~ 833 mW of maximum power under the temperature difference of 500 K.

BIOSKETCH

Han-Byul Kang (MSE, PhD Candidate, Virginia Tech), received his B.S. and M.S. degree in Materials Science and Engineering from Yonsei University in South Korea, 2011 and 2014, respectively. He researched various types of piezoelectric materials, including relaxor-PZT bulk ceramics, lead-free NKN nanofibers, and nanocomposite materials for flexible piezoelectric energy harvesting device. He currently works under the supervision of Dr. Shashank Priya at the Center for Energy Harvesting Materials and Systems (CEHMS). His current research focuses on nanostructured half-Heusler alloys for high temperature thermoelectric applications and nonlinear and terahertz studies of electro-optic and magneto-electric materials.