

Michigan State University
Science at the Edge
Engineering Seminar

March 6th, 2015

11:30 a.m., Room 1400 Biomedical and Physical Sciences Building
Refreshments served at 11:15 a.m.

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Panoscopic all-scale architecturing for high performance thermoelectrics

Abstract

Thermoelectrics convert heat energy to electricity. The nanostructuring approach to highly efficient thermoelectrics has produced a paradigm shift and ushered in a new era of investigation for efficient bulk thermoelectrics. Increasing the thermoelectric figure of merit can be accomplished via two general and effective approaches, nano- and meso-structuring to reduce the lattice thermal conductivity and altering the band structure to improve the power factor. Multiple methods of band structure engineering have been studied in this field but those with the ability to change the relative energy levels of the band near the Fermi energy and capable of aligning the energy level of the band structure of the a second phase added to the matrix are most effective. By aligning the valence band of the matrix and precipitate, high power factors can be maintained while reducing the lattice thermal conductivity by increasing phonon scattering with nanoprecipitates of the secondary phase. In the valence band of p-type PbQ (Q=S, Se, Te) thermoelectric materials have shown large improvements in ZT by adding second phases which perform the functions of nano- and meso-structuring and at the same time present good band alignment. This strategy has been demonstrated in several systems including p-type PbTe-SrTe, PbSe-(CdS/ZnS), and PbS-CdS systems. Progress using this hierarchical panoscopic approach will be reviewed.

Bio

Mercouri Kanatzidis was born in Thessaloniki, Greece in 1957. After obtaining a B. Sc from Aristotle University in Greece, he received his Ph D. in chemistry from the University of Iowa in 1984. He was a post-doctoral research associate at the University of Michigan and Northwestern University from 1985 to 1987 and is currently the the Charles E. and Emma H. Morrison Professor of Chemistry at Northwestern University. Mercouri moved to Northwestern in the fall of 2006 from Michigan State University where he was a University Distinguished Professor of Chemistry since 1987.

Mercouri also holds an appointment at [Argonne National Laboratory](#) and is the editor in chief of the [Journal of Solid State Chemistry](#)

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