Tim Hogan

Associate Professor
Electrical and Computer Engineering
Michigan State University
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Education

Ph.D.	**Northwestern University** Evanston, Illinois	(June 1996)
M.S.	**Northwestern University** Evanston, Illinois	(December 1993)
B.S.	**Michigan Technological University** Houghton, Michigan	(November 1988)

Research and Employment Experience

Michigan State University
Associate Professor (July, 2004 to present)
- Investigating temperature dependent (4.2K to 800K) transport measurements of electrical conductivity, thermoelectric power, thermal conductivity, and Hall effect while primarily studying thermoelectric materials and nanowire fabrication and characterization.

Michigan State University
Assistant Professor (August, 1998 to July, 2004)
- Investigated temperature dependent (4.2K to 800K) transport measurements of electrical conductivity, thermoelectric power, thermal conductivity, and Hall effect while primarily studying thermoelectric materials.

University of Houston
Research Scientist (June, 1997 to August, 1998)
- Studied the anisotropy of high temperature superconductors through microwave measurements of surface resistance and substrate anisotropy in a confocal resonator
- Wrote proposals for additional research funding and managed the installation of aclean room for photolithography

University of Houston
Postdoctoral Research Associate (June, 1996 to June, 1997)
- Researched the growth of gallium antimonide - antimony multilayer structures fabricated in a molecular beam epitaxy system
- Designed a cryogenic system for the measurement of ac and dc conductivity, and ac and dc Hall effect for the characterization of inline and van der Pauw structures as well as measurements of current vs. voltage on patterned diode structures
- Initiated research for the thermoelectric properties of porous materials
- Assisted in the design of a non-metallic cryostat for the characterization of high temperature superconducting magnetic resonance imaging coils

Northwestern University
Research Assistant (September, 1990 to June, 1996)
- Designed a system to characterize the surface resistance of superconductors as a function of temperature
- Utilized a multi-stage, closed-cycle cryogenic system for a temperature controlled study of the thermoelectric power of nickel disulfide as a function of selenium doping
- Designed a cryogenic system for the measurement of ac and dc conductivity, mutual inductance, current vs. voltage, thermoelectric power, and thermal conductivity
- Extensive experience in temperature dependent electrical measurements: ac and dc conductivity, thermoelectric power, mutual inductance, Hall effect, complex impedance, network and spectrum analysis. Experienced with cryogenics, high vacuum apparatus, photolithography and cleanroom techniques, CVD, evaporation, SEM, and x-ray analysis

Honors & Awards

National Science Foundation CAREER Award, 2001
Withrow Award for Distinguished Scholarship, Michigan State University, 2002.
Elected Senior Member to the Institute of Electrical and Electronics Engineers (IEEE), 2002.
Teacher Scholar Award, Michigan State University, 2004.

Publications

Patents:

1. M. G. Kanatzidis, D.-Y. Chung, C. R. Kannewurf, T. Hogan, L. Iordanidis, "Alkali Metal Chalcogenides of Bismuth Alone or with Antimony," Patent no. 6,013,204, Date of patent: January 11, 2000.

Books/Chapters:

1. **Materials and Technologies for Direct Thermal-to-Electric Energy Conversion**, Edited by J. Yang, T. P. Hogan, R. Funahashi, G. S. Nolas, in the **Materials Research Society Symposium Proceedings**, Vol. 886, Materials Research Society, Warrendale, PA, 2006.
2. T. P. Hogan and T. Shih, "Modeling and characterization of power generation modules based on bulk materials," Chapter 12 in **Thermoelectrics Handbook: Micro to Nano**, Edited by D. M. Rowe, CRC Press, 2005.
3. **Thermoelectric Materials 2003 – Research and Applications**, Edited by G. S. Nolas, J. Yang, T. P. Hogan, D. C. Johnson, in the **Materials Research Society Symposium Proceedings**, Vol. 793, Materials Research Society, Warrendale, PA, 2004.
4. **Chemistry, Physics, and Materials Science of Thermoelectric Materials: Beyond Bismuth Telluride**, Edited by M. G. Kanatzidis, S. D. Mahanti, and T. P. Hogan, in the **Fundamental Materials Research** series, Series Editor: M. F. Thorpe, Kluwer Academic / Plenum Publishers, New York, 2003.
5. T. Hogan, "Thermoelectricity" in the **Encyclopedia of Physical Science and Technology, Third Edition**, R. A. Meyers, editor-in-chief, Academic Press, San Diego, CA, 2001.

Refereed Journal Publications:

1. M. A. Khan, T. P. Hogan, B. Shanker, "Surface-Enhanced Raman Scattering from Gold Coated Semiconducting Nanowires," *Journal of Raman Spectroscopy*, accepted 2007.
2. J. Androulakis, C.-H. Lin, H.-J. Kong, C. Uher, C.-I. Wu, T. Hogan, B. A. Cook, T. Caillat, K. M. Paraskevopoulos, M. G. Kanatzidis, "Spinodal Decomposition and Nucleation and Growth as a Means to Bulk Nanostructured Thermoelectrics: Enhanced Perfomance in $Pb_{1-x}Sn_xTe$-PbS," *Journal of the American Chemical Society*, vol. 129, pp. 9780-9788, 2007.
3. A. D. Downey, T. P. Hogan, B. Cook, "Characterization of thermoelectric elements and devices by impedance spectroscopy," *Review of Scientific Instruments,* Vol. 78, No. 9, 2007.
4. T. Hogan, A. Downey, J. Short, J. D'Angelo, C.-I. Wu, E. Quarez, J. Androulakis, P. F. P. Poudeu, J. Sootsman, D.-Y. Chung, M. G. Kanatzidis, S. D. Mahanti, E. Timm, H. Schock, F. Ren, J. Johnson, E. Case, "Nanostructured Thermoelectric Materials and High Efficiency Power Generation Modules," *Journal of Electronic Materials*, Vol. 36, No. 7, pp. 704-710, 2007.
5. J. Androulakis, R. Pcionek, E. Quarez, J. H. Do, H. J. Kong, O. Palchik, C. Uher, J. J. D'Angelo, J. Short, T. Hogan, M. G. Kanatzidis, "Coexistence of large thermopower and degenerate doping in the nanostructured material $Ag_{0.85}SnSb_{1.15}Te_3$," *Chemistry of Materials*, Vol. 18, No. 20, pp. 4719-4721, 2006.
6. P. F. P. Poudeu, J. D'Angelo, A. Downey, J. L. Short, T. P. Hogan, M. G. Kanatzidis, "High thermoelectric figure of merit and nanostructuring in bulk p-type $Na_{1-x}Pb_mSb_yTe_{m+2}$," *Angewandte Chemie-International Edition*, Vol. 45, No. 23, pp. 3835-3839, 2006.
7. J. Androulakis, K. F. Hsu, R. Pcionek, H. Kong, C. Uher, J. J. D'Angelo, A. Downey, T. Hogan, M. G. Kanatzidis, "Nanostructuring and high thermoelectric efficiency in p-type $Ag(Pb_{1-y}Sn_y)_{(m)}SbTe_{2+m}$," *Advanced Materials*, Vol. 18, No. 9, pp. 1170-1173, 2006.
8. P. F. P. Poudeu, J. D'Angelo, H. J. Kong, A. Downey, R. Pcionek, T. P. Hogan, C. Uher, M. G. Kanatzidis, "Nanostructures versus solid solutions: Low lattice thermal conductivity and enhanced thermoelectric figure of merit in $Pb_{9.6}Sb_{0.2}Te_{10-x}Se_x$ bulk materials," *Journal of the American Chemical Society*, Vol. 128, No. 44, pp. 14347-14355, 2006.
9. J. H. Kim, D. Y. Chung, D. Bilc, S. Loo, J. Short, S. D. Mahanti, T. Hogan, M. G. Kanatzidis, "Crystal growth, thermoelectric properties, and electronic structure of $AgBi_3S_5$ and $AgSb_xBi_{3-x}S_5$ (x=0.3)," *Chemistry of Materials*, vol. 17, no. 14, pp. 3606-3614, 2005.
10. F. Guo, J.G. Lee, T. Hogan, K.N. Subramanian, "Electrical conductivity changes in bulk Sn, and eutectic Sn-Ag in bulk and in joints, from aging and thermal shock," *Journal of Materials Research*, vol. 20, no. 2, pp. 364-374, 2005.

11. C. H. Kim, S.-S. Kim, F. Guo, T. P. Hogan, T. J. Pinnavaia, Polymer Intercalation in Mesostructured Carbon," *Advanced Materials*, vol. 16, no. 8, pp. 736-739, 2004.

12. J. R. Salvador, D. Bilc, S. D. Mahanti, T. Hogan, F. Guo, M. G. Kanatzidis, "Yb8Ge3Sb5, a Metallic Mixed-Valent Zintl Phase Containing the Polymeric $^{1}_{\infty}[Ge_3^{4-}]$ Anions, *Journal of the American Chemical Society*, vol. 126, no. 14, pp. 4474-4475, 2004.

13. D.-Y. Chung, T. P. Hogan, M. Rocci-Lane, P. Brazis, J. R. Ireland, C. R. Kannewurf, M. Bastea, C. Uher, M. G. Kanatzidis, "A New Thermoelectric Material: $CsBi_4Te_6$," *Journal of the American Chemical Society*, vol. 126, no. 20, pp. 6414-6428, 2004.

14. K.-F. Hsu, S. Loo, F. Guo, W. Chen, J. S. Dyck, C. Uher, T. Hogan, E. K. Pobchroniadis, M. G. Kanatzidis, "Cubic $AgPb_mSbTe_{2+m}$: Bulk Thermoelectric Materials with High Figure of Merit," *Science*, vol. 303, no. 5659, pp 818-820, 2004.

15. H. D. Park, T. P. Hogan, "Growth of Si wires on a Si(111) substrate under ultra high vacuum condition," *Journal of Vacuum Science and Technology B*, vol. 22, no. 1, 2004.

16. J. R. Salvador, F. Guo, T. Hogan, M. G. Kanatzidis, "Zero Thermal Expansion in YbGaGe Due to Valence Transition," *Nature*, Vol. 425, pp. 702-705, 2003.

17. A. Ambrosini, G. B. Palmer, A. Maignan, K. R. Poeppelmeier, M. A. Lane, P. W. Brazis, C. R. Kannewurf, T. Hogan, T. O. Mason, "Variable-Temperature Electrical Measurements of Zinc Oxide/Tin Oxide – Cosubstituted Indium Oxide," *Chemistry of Materials*, vol. 14, no. 1, pp. 52-57, 2002.

18. K.-F. Hsu, S. Lal, T. Hogan, M. G. Kanatzidis, "$CsPb_3Bi_3Te_8$ and $CsPb_4Bi_3Te_9$: Low-Dimensional Compounds and the Homologous Series $CsPb_mBi_3Te_{5+m}$," *Chemical Communications*, Vol. 13, pp. 1380-1381, 2002.

19. K.-F. Hsu, D.-Y. Chung, S. Lal, A. Mrotzek, T. Kyratsi, T. Hogan, M. G. Kanatzidis, "$CsMBi_3Te_6$ and $CsM_2Bi_3Te_7$ (M=Pb, Sn): New Thermoelectric Compounds with Low-Dimensional Structures," *Journal of the American Chemical Society*, Vol. 124, No. 11, pp. 2410-2411, 2002.

20. A. Mrotzek, D.-Y. Chung, N. Ghelani, T. Hogan, M. G. Kanatzidis, "Structure and thermoelectric properties of the new quaternary bismuth selenides A(1-x)M(4-x)Bi(11+x)Se(21) (A = K and Rb and Cs; M = Sn and Pb) - Members of the grand homologous series K-m(M6Se8)(m)(M5+nSe9+n)," *Chemistry-A European Journal*, vol. 7, no. 9, pp. 1915-1926, 2001.

21. K. S. Choi, D.-Y. Chung, A. Mrotzek, P. Brazis, C. R. Kannewurf, C. Uher, W. Chen, T. Hogan, M. G. Kanatzidis, "Modular construction of A(1+x)M(4-2x)M ' Se-7+x(15) (A = K, Rb; M = Pb, Sn; M ' = Bi, Sb): A new class of solid state quaternary thermoelectric compounds," *Chemistry of Materials*, vol. 13, no. 3, pp. 756-764 2001.

22. L. Iordanidis, P. W. Brazis, T. Kyratsi, J. Ireland, M. Lane, C. R. Kannewurf, W. Chen, J. S. Dyck, C. Uher, N. A. Ghelani, T. Hogan, M. G. Kanatzidis, "A(2)Bi(8)Se(13) (A = Rb, Cs), $CsBi_{3.67}Se_6$, and $BaBi_2Se_4$: New ternary semiconducting bismuth selenides," *Chemistry of Materials*, vol. 13, no. 2, pp. 622-633, 2001.

23. S.-J. Kim, S. Hu, C. Uher, T. Hogan, B. Haung, J. D. Corbett, M. G. Kanatzidis, "Structure and Thermoelectric Properties of Ba_6Ge_{25-x}, $Ba_6Ge_{23}Sn_2$, and $Ba_6Ge_{22}In_3$: Zintl Phases with a Chiral Clathrate Structure," *Journal of Solid State Chemistry*, vol. 153, pp. 321-329, 2000.

24. A. Mrotzek, D.-Y. Chung, T. Hogan, M. G. Kanatzidis, "Structure and Thermoelectric Properties of the New Quaternary Tin Selenide $K_{1-x}Sn_{5-x}Bi_{11+x}Se_{22}$," *Journal of Materials Chemistry*, vol. 10, pp. 1667-1672, 2000.

25. D.Y. Chung, T. Hogan, P. Brazis, M. Rocci-Lane, C. R. Kannewurf, M. Bastea, C. Uher, M. G. Kanatzidis, "$CsBi_4Te_6$: A High-Performance Thermoelectric Material for Low-Temperature Applications," *Science*, Vol. 287, No. 5455, pp. 1024-1027, 2000.

26. D. Washington-Stokes, T. P. Hogan, P. C. Chow, T. D. Golding, U. Kirschbaum, C. L. Littler, R. Lukic, "$Al_xIn_{1-x}As_{1-y}Sb_y$/GaSb Effective Mass Superlattices Grown by Molecular Beam Epitaxy," *Journal of Crystal Growth*, Vol. 201/202, pp. 854-857, 1999.

27. J. Wosik, L. M. Xie, R. Grabovickic, T. Hogan, S. A. Long, "Microwave Power Handling Capability of HTS Superconducting Thin Films: Weak Links and Thermal Effects Induced Limitation," *IEEE Transactions on Applied Superconductivity*, Vol. 9, No. 2, pp. 2456-2459, 1999.

28. D. Washington, T. Hogan, P. Chow, T. Golding, C. Littler, U. Kirschbaum, "$Al_{1-x}In_xAs_{1-y}Sb_y$/GaSb heterojunctions and multilayers grown by molecular beam epitaxy for effective-mass superlattices," *Journal of Vacuum Science & Technology B*, Vol. 16, No. 3, pp. 1385-1388, 1998.

29. B. J. Hinds, R. J. McNeely, J. Chen, C. Dias, D. L. Studebaker, T. J. Marks, T. P. Hogan, J. L. Schindler, C. R. Kannewurf, "MOCVD routes to Tl-2212/MgO/Tl-2212 trilayers – prliminary observations on growth and microstructural/electrical properties," *Journal of Alloys and Compounds*, Vol. 351, pp. 328-331, 1997.

30. B. J. Hinds, R. J. McNeely, D. B. Studebaker, T. J. Marks, T. P. Hogan, J. L. Schindler, C. R. Kannewurf, X. F. Zhang, and D. J. Miller, "Thin films for superconducting electronics: Precursor performance issues, deposition mechanisms, and superconducting phase formation-processing strategies in the growth of $Tl_2Ba_2CaCu_2O_8$ films by metal-organic chemical vapor deposition," *Journal of Materials Research*, Vol. 12, No. 5, pp. 1214-1236, 1997.

31. J. L. Schindler, T. P. Hogan, P. W. Brazis, C. R. Kannewurf, D.-Y. Chung, M.G. Kanatzidis, "Electrical Properties and Figures of Merit for New Chalcogenide-Based Thermoelectric Materials," *Materials Research Society symposia proceedings*, San Francisco, CA, Spring 1997.

32. D.-Y. Chung, S. Jobic, T. Hogan, C. R. Kannewurf, R. Brec, J. Rouxel, M. G. Kanatzidis, "Oligomerization Versus Polymerization of Te_x^{n-} in the Polytelluride Compound $BaBiTe_3$. Structural Characterization, Electronic Structure, and Thermoelectric Properties," *Journal of the American Chemical Society*, Vol. 119, No. 10, pp. 2505-2515, 1997.

33. X. Zhang, M. G. Kanatzidis, T. Hogan, C. R. Kannewurf, "$NaCu_4S_4$, a Simple New Low-Dimensional, Metallic Copper Polychalcogenide, Structurally Related to CuS," *Journal of the American Chemical Society*, Vol. 118, No. 3, pp. 693-694, 1996.

34. M. G. Kanatzidis, T. J. McCarthy, T. A. Tanzer, Li-H. Chen, L. Iordanidis, T. Hogan, C. R. Kannewurf, C. Uher, and B. Chen, "Synthesis and Thermoelectric Properties of the New Ternary Bismuth Sulfides $KBi_{6.33}S_{10}$ and $K_2Bi_8S_{13}$," *Chemistry of Materials*, Vol. 8, No. 7, pp. 1465-1474, 1996.

35. S. Mahajan, D. B. Buchholz, J. Lei, T. Hogan, S. N . Song, B. Hinds, C. R. Kannewurf, T. J. Marks, J. B. Ketterson, J. Eckstein, and R. P. H. Chang, "Fabrication and Characteristics of Weak Links Between â and ĉ -axis Normal Grains of $Y_1Ba_2Cu_3O_{7-x}$," *Journal of Materials Research*, Vol. 11, No. 5, p. 1086, 1996.

36. X. Zhang, T. Hogan, C. R. Kannewurf, M. G. Kanatzidis, "Sulfur p-Band Hole Generation in β-$BaCu_2S_2$. Synthesis of Metallic $K_xBa_{1-x}Cu_2S_2$ from Molten Mixed K/Ba Polysulfide Salts," *Journal of Alloys and Compounds*, Vol. 236, pp. 1-5, 1996.

37. X. Yao, T. Hogan, C. Kannewurf, and J. M. Honig, "Electrical Properties of $NiS_{2-x}Se_x$ Crystals," *Physical Review B*, Vol. 54, No. 24, pp. 17469, 1996.

38. A. C. Sutovik, J. Albritton Thomas, T. Hogan, C. R. Kannewurf and M. G. Kanatzidis, "New Quaternary Compounds Resulting from the Reaction of Copper and *f*-block Metals in Molten Polychalcogenide Salts at Intermediate Temperatures; Valence Fluctuations in the Layered $CsCuCeS_3$," *Chemistry of Materials*, Vol. 8, No. 3, pp. 751-761, 1996.

39. X. Zhang, J. Li, B. Foran, S. Lee, H.-Y. Guo, T. Hogan, C. R. Kannewurf, M. G. Kanatzidis, "Distorted Square Nets of Tellurium in the Novel Quaternary Polytelluride $K_{0.33}Ba_{0.67}AgTe_2$," J*ournal of the American Chemical Society*, Vol. 117, No. 42, pp. 10513-10520, 1995.

40. B. J. Hinds, D. B. Studebaker, J. Chen, R. J. McNealy, B. Han, J. L. Schindler, T. P. Hogan, C. R. Kannewurf, and T. J. Marks, "MOCVD Route to $Tl_2Ba_2Ca_{n-1}Cu_nO_{4+2n}$ Superconductor and Dielectric Insulator Thin Films," *Journal De Physique IV*, Vol. 5, No. 6, pp. C5-391 to C5-406, 1995.

41. X. Zhang, Y. Park, T. Hogan, J. L. Schindler, C. R. Kannewurf, S. Seong, T. Albright, and M. G. Kanatzidis, "Reactivity of Copper in Molten Polytelluride Salts. $K_4Cu_8Te_{11}$, $A_3Cu_8Te_{10}$ (A = Rb,Cs), $AA'_2Cu_8Te_{10}$ (A, A' = K, Rb, Cs) and $A_2BaCu_8Te_{10}$ (A = K, Rb, Cs): Novel Solids Based on Endohedrally Occupied $[Cu_8Te_{12}]$ Dodecahedral Cage-Clusters," *Journal of the American Chemical Society*, Vol. 117, No. 41, pp. 10300-10310, 1995.

42. X. Zhang, J. L. Schindler, T. Hogan, J. Albritton-Thomas, C. R. Kannewurf, and M. G. Kanatzidis, "The Novel Copper Polytelluride Salts $NaBa_6Cu_3Te_{14}$ and $(K_{0.60}Ba_{0.40})Ba_6Cu_{2.58}Te_{14}$: Discrete Clusters or Extended Solids?" *Angewandte Chemie International Edition in English*, Vol. 34, No. 1, pp. 68-71, 1995.

43. D. C. DeGroot, T. P. Hogan, C. R. Kannewurf, D. B. Buchholz, R. P. H. Chang, F. Gao, M. Feng, R. A. Nordin, "Microwave Surface-Resistance of $YBa_2Cu_3O_{7-\delta}$ Thin Films Deposited by Pulsed Organometallic Beam Epitaxy," *Physica C*, Vol. 222, No. 3-4, pp. 271-277, 1994.

44. T. J. McCarthy, T. Hogan, C. R. Kannewurf, M. G. Kanatzidis, "Sb . . . Sb and Bi . . . Bi Interactions in $Cs_8M_4(P_2Se_6)_5$ (M = Sb, Bi)," *Chemistry of Materials*, Vol. 6, No. 7, pp. 1072-1079, 1994.

45. B. J. Hinds, D. L. Schulz, D. A. Neumayer, B. Han, T. J. Marks, Y. Y Wang, V. P. Dravid, J. L. Schindler, T. P. Hogan, C. R. Kannewurf, "Metal-Organic Chemical Vapor Deposition Open Flow Thallium Annealing Route to Epitaxial $Tl_2Ba_2Ca_2Cu_3O_{10}$ Thin Films," *Applied Physics Letters*, Vol. 65, pp. 231-233, 1994.

46. T. J. McCarthy, S. P. Ngeyi, J. H. Liao, D. C. DeGroot, T. Hogan, C. R. Kannewurf, and M. G. Kanatzidis, "Molten-Salt Synthesis and Properties of 3 New Solid-State Ternary Bismuth Chalcogenides, β-$CsBiS_2$, γ-$CsBiS_2$, and $K_2Bi_8Se_{13}$," *Chemistry of Materials*, Vol. 5, No. 3, pp. 331-340, 1993.

47. D. L. Schulz, D. Neumayer, B. Han, T. J. Marks, D. C. DeGroot, J. L. Schindler, T. Hogan, C. R. Kannewurf, "Deposition of Superconducting Tl-Ba-Ca-Cu-O Phases by MOCVD," Layered Superconductors: Fabrication, Properties, and Application, edited by D. T. Shaw, T. R. Schneider, C. C. Tsuei, and Y. Shiohara, (Materials Research Society, Pittsburgh, PA, 1992).

48. D. L. Schulz, D. S. Richeson, G. Malandrino, D. Neumayer, T. J. Marks, D. C. DeGroot, J. L. Schindler, T. Hogan, and C. R. Kannewurf, "Deposition of Highly Oriented Superconducting Tl-Ba-Ca-Cu-O Films on Metallic Substrates," *Thin Solid Films*, Vol. 216, pp. 45-48, 1992.

49. J. F. Mitchell, J, K. Burdett, P. M. Keane, J. A. Ibers, D. C. DeGroot, T. P. Hogan, J. L. Schindler, and C. R. Kannewurf, "A Theoretical and Experimental-Study of the Electronic Transport-Properties of the Compounds Cu_2Mte_3 (M = Ti, Zr, Hf)," *Journal of Solid State Chemistry*, Vol. 99, No. 1, pp. 103-109, 1992.

Reviewed Conference Proceedings Papers:

1. T. Hogan, A. Downey, J. Short, J. D'Angelo, C.-I. Wu, E. Quarez, J. Androulakis, P. F. P. Poudeu, J. Sootsman, D.-Y. Chung, M. G. Kanatzidis, S. D. Mahanti, E. Timm, H. Schock, F. Ren, J. Johnson, E. Case, "Nanostructured Thermoelectric Materials and High Efficiency Power Generation Modules," Invited Talk presented at the *Materials Science and Technology Conference*, Cincinnati, OH, 2006.

2. T. P. Hogan, A. D. Downey, J. Short, J. D'Angelo, E. Quarez, J. Androulakis, P. F. P. Poudeu, M. G. Kanatzidis, E. Timm, K. Sarbo, H. Schock, "Progress on the Fabrication and Characterization of High Efficiency Thermoelectric Generators," Presented at the *Materials Research Society Meeting*, Boston, 2005.

3. J. D'Angelo, J. L. Short, A. D. Downey, M. A. Pajor, E. Timm, H. Schock, D.-Y. Chung, M. G. Kanatzidis, T. P. Hogan, "Investigation of Low Resistance Contacts to Pb-Sb-Ag-Te (LAST) Materials for Module Fabrication," Presented at the *Materials Research Society Meeting*, Boston, 2005.

4. A. D. Downey, E. Timm, P. F. P. Poudeu, M. G. Kanatzidis, H. Shock, T. P. Hogan, "Application of Transmission Line Theory for Modeling of a Thermoelectric Module in Multiple Configurations for AC Electrical Measurements," Presented at the *Materials Research Society Meeting*, Boston, 2005.

5. J. L. Short, J. D'Angelo, A. D. Downey, M. A. Pajor, E. Timm, H.Schock, M. G. Kanatzidis, T. P. Hogan, "Characterization of Thermoelectric Power Generation Modules Made from New Materials," Presented at the *Materials Research Society Meeting*, Boston, 2005.

6. J. Androulakis, R. Pcionek, E. Quarez, O.Palchik, H. Kong, C. Uher, J. J. Dangelo, T. Hogan, X. Tang, T. Tritt, and M. G. Kanatzidis, "Nanostructuring and its Influence on the Thermoelectric Properties of the $AgSbTe_2$-SnTe Quaternary System," Presented at the *Materials Research Society Meeting*, Boston, 2005.

7. P. F. P. Poudeu, J. D'Angelo, A. Downey, R. Pcionek, J. Sootsman, Z. Zhou, O. Palchik, T. P. Hogan, C. Uher, and M. G. Kanatzidis, "Effects of Antimony on the Thermoelectric Properties of the Cubic $Pb_{9.6}Sb_yTe_{10-x}Se_x$ Materials," Presented at the *Materials Research Society Meeting*, Boston, 2005.

8. T. Kyratsi, S. Lal, T. Hogan, and M. G. Kanatzidis, "Thermoelectric Properties of $K_2Bi_8Se_{13-x}S_x$ Solid Solutions," Presented at the *Materials Research Society Meeting*, Boston, 2005.

9. A. D. Downey, T. P. Hogan, "Circuit model of a thermoelectric module for AC electrical measurements," presented at the International Thermoelectrics Conference, Clemson, SC, USA 2005. *ICT2005 Proceedings*, IEEE Publishing, 2005.

10. T. Hogan, S. Loo, F. Guo, J. Short, "Measurement Techniques for Thermoelectric Materials and Modules," *Materials Research Society symposia proceedings*, vol. 793, pp. 405-411, 2004.

11. T. Kyratsi, D. Y. Chung, J. S. Dyck, C. Uher, S. Lal, S. Loo, T. Hogan, J. Ireland, C. R. Kannewurf, E. Hatzikraniotis, "Synthesis, Crystal Structure and Thermoelectric Properties of β-$K_2Bi_8Se_{13}$ Solid Solutions," *Materials Research Society symposia proceedings*, vol. 793, pp. 359-364, 2004.

12. S. Loo, J. Short, K. F. Hsu, M. G. Kanatzidis, T. Hogan, "High Temperature Measurement System Design for Thermoelectric Materials in Power Generation Application ," *Materials Research Society symposia proceedings*, vol. 793, pp. 375-384, 2004.

13. J. Short, S. Loo, S. Lal, K.-F. Hsu, E. Quarez, M. G. Kanatzidis, T. P. Hogan, "Hall Effect Measurements on New Thermoelectric Materials," *Materials Research Society symposia proceedings*, vol. 793, pp. 323-332, 2004.

14. J.-H. Kim, D. Bilc, S. Loo, J. Short, S. D. Mahanti, T. Hogan, M. G. Kanatzidis, "Synthesis and Thermoelectric Properties of $AgBi_3S_5$," *Materials Research Society symposia proceedings*, vol. 793, pp 201-206, 2004.

15. K.-F. Hsu, S. Loo, W. Chen, C. Uher, T. Hogan, M. G. Kanatzidis, "Thermoelectric Properties of the Cubic $AgPb_{10}SbTe_{12}$," *Materials Research Society symposia proceedings*, vol. 793, pp. 155-160, 2004.

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