Andrew F. May

Chemical Engineering, California Institute of Technology
1200 E. California Blvd, MC 210-41, Pasadena CA 91125
Tel: (814) 574-9726, Fax: (626) 395-8868
E-mail: may@caltech.edu

Education

Ph.D., Chemical Engineering, Materials Science Emphasis, California Institute of Technology. (expected June, 2010)
Advisors: G. Jeffrey Snyder and Sossina M. Haile
Thesis: "High-temperature transport in Lanthanum telluride and other modern thermoelectric materials"

M.S., Chemical Engineering, California Institute of Technology, (June, 2007)
Thesis: "Refractory Thermoelectric Materials by Mechanical Alloying"

B.S., Chemical Engineering, Pennsylvania State University, (December, 2004)
Minor: Environmental Science and Engineering
Research advisor: Janna K. Maranas
Research focus: Polymer physics

Research Experience

California Institute of Technology — September 2005 – present
Research Assistant — Advisor: G. Jeffrey Snyder

Materials physics of thermoelectric energy conversion at high temperatures

- Synthesis of polycrystalline samples utilizing mechanical alloying, traditional melt procedures, and hot pressing; phase analysis by powder X-ray diffraction
- Characterization of electrical and thermal transport between room temperature and 1273 K. Material properties measured: electrical resistivity, Hall coefficient, Seebeck coefficient, thermal diffusivity, sound velocity, specific heat
- Analysis and modeling of transport data using semi-classical models employing solutions to the Boltzmann transport equation. Collaborations with theorists performing *ab initio* band structure calculations complement this analysis
- Primary compounds investigated: $La_{3-x}Te_4$, $Ba_8Ga_{16-x}Ge_{30+x}$, LiZnSb, $SrZnSb_2$, $SrZn_2Sb_2$, $Yb_{14}MnSb_{11}$

Pennsylvania State University — May 2003 – May 2005
Undergraduate Research Assistant — Research Advisor: Janna K. Maranas

Polymer physics

- Utilized molecular dynamics code to examine impact of intra-chain connectivity on local packing and dynamics of polyolefins (UNIX)
- Generated programs in FORTRAN to extract various material properties from the simulation results, such as the intra and inter-chain pair distribution functions and the self-intermediate scattering function

Selected Publications

Invited Reviews

"Zintl chemistry for designing high efficiency thermoelectric materials." E. S. Toberer, A. F. May, and G. J. Snyder, Chem. Mater. **22** 624 (2010).DOI

Articles

"Optimizing thermoelectric efficiency in $La_{3-x}Te_4$ via Yb substitution" A. F. May, J.-P. Fleurial, and G. J. Snyder, Chem. Mater. (*Articles ASAP*).DOI

"Valence band study of thermoelectric Zintl $SrZn_2Sb_2$ and $YbZn_2Sb_2$: X-ray photoelectron spectroscopy and density-functional theory" E. Flage-Larsen, S. Diplas, Ø. Prytz, E. S. Toberer, and A. F. May, Phys. Rev. B (*in press*).

"Electron and phonon scattering in the high temperature thermoelectric $La_3Te_{4-z}M_z$, M= Sb,Bi." A. F. May, E. Flage-Larsen, and G. J. Snyder, Phys. Rev. B **81** 125205 (2010).DOI

"Phonon density of states and heat capacity of $La_{3-x}Te_4$." O. Delaire, A. F. May, M. A. McGuire, W. D. Porter, M. S. Lucas, M. B. Stone, D. L. Abernathy, V. A. Ravi, S. A. Firdosi, and G. J. Snyder, Phys. Rev. B **80** 184302 (2009).DOI

"Electronic structure and transport in thermoelectric compounds AZn_2Sb_2 (A = Sr, Ca, Yb, Eu)." E. S. Toberer, A. F. May, B. Melot, E. Flage-Larsen, and G. J. Snyder, Dalton Trans. **39** 1046 (2010).DOI

"Characterization and analysis of thermoelectric transport in n-type $Ba_8Ga_{16-x}Ge_{30+x}$." A. F. May, E. S. Toberer, A. Saramat, and G. J. Snyder, Phys. Rev. B **80** 125205 (2009).DOI

"Transport properties of the layered Zintl compound $SrZnSb_2$." A. F. May, E. S. Toberer, and G. J. Snyder, J. Appl. Phys. **106** 013706 (2009).DOI

"Influence of band structure on the large thermoelectric performance of lanthanum telluride." A. F. May, D. J. Singh, and G. J. Snyder, Phys. Rev. B **79** 153101 (2009).DOI

"Thermoelectric properties of p-type LiZnSb: Assessment of *ab initio* calculations." E. S. Toberer, A. F. May, C. Scanlon, and G. J. Snyder, J. Appl. Phys. **105** 063701 (2009).DOI

"Thermoelectric performance of lanthanum telluride produced via mechanical alloying." A. F. May, J.-P. Fleurial, and G. J. Snyder, Phys. Rev. B **78** 125205 (2008).DOI

"Traversing the metal-insulator transition in a Zintl phase: Rational enhancement of thermoelectric efficiency in $Yb_{14}Mn_{1-x}Al_xSb_{11}$." E. S. Toberer, C. A. Cox, S. R. Brown, T. Ikeda, A. F. May, S. M. Kauzlarich and G. J. Snyder, Adv. Funct. Mater. **18** 2795 (2008).DOI

"The single chain limit of structural relaxation in a polyolefin blend." A. F. May and J. K. Maranas, J. Chem. Phys. **125** 024906 (2006).DOI

"The role of environment in structural relaxation of miscible polymer blends." A. Neelakantan, A. May, and J. K. Maranas, Macromolecules **38** 6598 (2005).DOI

Awards

- 2010 Goldsmid Award for Excellence in Research in Thermoelectrics by a Graduate Student, awarded by the International Thermoelectric Society
- Division of Materials Physics' Ovshinsky Student Award for the March, 2010 Meeting of the American Physical Society
- NASA Tech-Brief Award, *Mechanical Alloying for Making Thermoelectrics*, (Sept 2007)
- Robert and Nancy Frantz Centennial Scholarship (Apr 2002)
- Charles B. Manula Memorial Scholarship (Apr 2002)

Conference Presentations

2010 American Physical Society March Meeting, Portland, OR. (oral)
2009 International Conference on Thermoelectrics, Freiburg, Germany. (oral)
2008 Materials Science and Technology Conference, Pittsburgh, PA. (oral)
International Conference on Thermoelectrics, Corvallis, OR. (oral, poster)
Space Tech. and App. Int. Forum, Albuquerque, NM. (oral, proceedings)
2007 Materials Research Society Meeting, Boston, MA. (poster)
Electronic Materials Conference, Notre Dame, IN. (oral)
2005 American Physical Society March Meeting, Los Angeles, CA. (oral)

Outreach and Activities

- Referee for Physical Review B, Journal of Applied Physics, Journal of Electronic Materials, Applied Physics Letters
- Member of the American Physical Society and Materials Research Society
- Teaching assistant: *Principles of Materials I*, Fall 2008, 2009; *Chemical Kinetics and Industrial Chemistry*, Fall 2004; *Mapping the Changing World*, Spring 2002
- Elementary school volunteer: Assistance with science labs for sixth grade students at Burbank Elementary School (May-Dec 2009) and with the eighth grade students at Eliot Middle School (Sept 2009 - Dec 2009); Pasadena, CA
- Caltech Earth Day Celebration, Organizer of Graduate Student Poster Section (2009)
- East Los Angeles Community College Science Club Presentation Series, *The Science of Energy, A Focus on Thermoelectric Energy Conversion*, (Oct 2008)
- Materials Research Lecture Series Coordinator, Caltech, (2008-Present)
- Center for Talented Youth Energy and Environment Conference, Caltech, Assistant/Lab tours (2006-2008)

References available upon request