Thermoelectric Materials 2000
The Next Generation Materials for Small-Scale Refrigeration and Power Generation

Terry M. Tritt (Editor), G. Mahan (Editor), M. G. Kanatzidis (Editor), G. S. Nolas (Editor), D. Mandrus (Editor) (2001)

Editorial Review from Book News, Inc.:

The presentations from the symposium are grouped into the following topics: skutterudites, superlattice, new materials, quantum wires and dots, half-heusler alloys and quasicrystals, TE theory, thermionics, clathrates, and thin films TE. In addition, poster sessions include the following: semiconductors with tetrahedral anions as potential thermoelectric materials, lattice dynamics study of anisotropic heat conduction in supperlattices, structure and thermoelectric properties of new quaternary tin and lead Bismuth selenides, attributes of the Seebeck coefficient of Bismuth microwire array composites, and High-Z Lanthanum-Cerium Hexaborate thin films for low-temperature applications.Book News, Inc.®, Portland, OR

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(603) 888-2467 · fax: (603) 888-4035 · e-mail: sales@tecooling.com

Our recommended reading list:

- CRC Handbook of Thermoelectrics (1995)
- Principles of Thermoelectrics: Basics and New Materials Development (2001)
- Thermoelectric Materials 2000 - The Next Generation Materials for Small-Scale Refrigeration and Power Generation (2001)
- Semiconductors and Semimetals, Volume 69: Recent Trends in Thermoelectric Materials Research, Part One (2000)
- Semiconductors and Semimetals, Volume 70: Recent Trends in Thermoelectric Materials Research, Part Two (2000)
- Semiconductors and Semimetals, Volume 71: Recent Trends in Thermoelectric Materials Research: Part Three (2000)
- Thermoelectric Materials - New Directions & Approaches (1997)

2.2 Thermoelectricity. Thermoelectric materials endow the free energy from waste heat for useful purposes. A typical thermoelectric material should have high electrical conductivity, low thermal conductivity and thus must maintain a temperature gradient. For an electrically conducting polymer nanocomposites, the electrical conductivity (Ïƒ) is expressed as Eq. They are also the best materials for use in thermoelectric generators when the temperature of the heat source is moderate. The dimensionless figure of merit, ZT, usually rises with temperature, as long as there is only one type of charge carrier. Eventually, though, minority carrier conduction becomes significant and ZT decreases above a certain temperature. There is also the possibility of chemical decomposition due to the vaporization of tellurium. Here we discuss the likely temperature dependence of the thermoelectric parameters and the means by which the composition may be optimized for ap

For example, one material might be exposed to the inside of a refrigerator and the other to ambient room conditions in a next generation refrigerator. Or, one material may be exposed to an inside temperature of a spacecraft and the other to ambient cold-space temperature in a power-generation application. Integrated Circuits. Conventional integrated circuits suffer CMOS tunneling breakdown due to the smaller 2.5-nanometer device size used today.Â Society, Thermoelectric Materials 1998â€"The Next Generation Materials for Small-Scale Refrigeration and Power Generation Applications Symposium, Proceedings (eds.: Terry M. Tritt, et al.), Vol. 545, November 30â€"December 3, 1998, Boston Massachusetts, p. 391â€"397. 5. Weise, P., March 25, 2000. 5. Koga, T., Sun, X., Cronin, S.B., and Dresselhaus, M.S., In Thermoelectric Materials-The Next Generation Materials for Small-Scale Refrigeration and Power Generation Applications: MRS Symposium Proceedings, Boston, volume 545, edited by Tritt, T.M., Lyon, H.B. Jr, Mahan, G.D., and Kanatzidis, M.G., pages 375â€"380, Materials Research Society Press, Pittsburge, PA, 1999.Â Lett. 75, 2438 (1999). 7. Koga, T., Sun, X., Cronin, S.B., and Dresselhaus, M.S., In The 18th International Conference on Thermoelectrics: ICT Symposium Proceedings, Baltimore, Institute of Electrical and Electronics Engineer, Inc., Piscataway, NJ 09955â€"1331, 1999. 8. Liu, J.L., Moore, C.D., U'Ren, G.D., Lou, Y.H., Lu, Y., Jin, G., Thomas, S.G., Goorsky, M.S., and Wang, K.L., Appl.

2.2 Thermoelectricity. Thermoelectric materials endow the free energy from waste heat for useful purposes. A typical thermoelectric material should have high electrical conductivity, low thermal conductivity and thus must maintain a temperature gradient.Â Thermoelectric materials are characterized by ZT, that is, they show large Seebeck coefficient, high conductivity, and low thermal conductivity at the same time. Such requirements are difficult to be satisfied, because the three parameters are functions of carrier concentration, which cannot be tuned independently.Â In other words, conventional metals have very small Seebeck coefficient, while conventional semiconductors have very low conductivity. Symposium Z, "Thermoelectric Materials 2000â€"The Next Generation Materials for Small-Scale Refrigeration and Power Generation Applications," held April 24-27 at the 2000 MRS Spring Meeting in San Francisco, California, was the fourth in a series of MRS symposia which are specifically related to research in new thermoelectric materials [see MRS Symposium Proceedings Vol. 234 (1991), Vol. 478 (1997) and.Â In addition, George Nolas of Marlow Industries and Brian Sales of Oak Ridge National Laboratory presented results on a Yb partially filled skutterudite with ZT > 1 at 300 Â°C. There were also many interesting results in the clathrates, skutterudites, quasicrystals and novel chalcogenide materials systems as well as in III-V compounds for thermionic refrigeration. Thermoelectric power generation-materials. what makes a good thermoelectric: ZT. = Î±2 ÏÎ». T. conflicting requirements. Î± â€" Seebeck coefficient - large. Ï â€" resistivity.Â For almost all typical thermoelectric materials, namely low gap semiconductors, if doping is increased, the electrical conductivity increases but the Seebeck coefficient is reduced. P. f. = Î±. 2. Ï. 3.