Abstract Submitted
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Enhancement of thermoelectric performance in composite materials through locally-modulated doping[1] MICHAEL J. ADAMS, HYUNGYU JIN, Department of Mechanical Engineering, The Ohio State University, JOSEPH P. HEREMANS, Department of Mechanical Engineering and Department of Physics, The Ohio State University — Composites of organic or inorganic constituents are often considered as a way to yield high thermoelectric figure of merit. The limit of this approach is set by the effective medium theory [1], which demonstrates formally that a composite of two materials A and B cannot have higher figure of merit than the highest of either A or B, in the absence of interaction between A and B. In this work, we show that this limit can be lifted by introducing into a host material a second phase that behaves differently vis-a-vis electrons than vis-a-vis phonons. This phase consists of electrically and thermally insulating islands of material that locally dope the semiconducting host. Doped material near the islands provides electrically conductive volumes for charge carriers. Phonons, unaffected by local doping, are scattered by the islands. Thermopower is less affected by the doped regions than electrical conductivity, by an intrinsic mathematical property of the effective medium theory [1]. We employ this concept in $Bi_{1-x}Sb_x$ alloys and in p-type $(Bi_{1-x}Sb_x)_2Te_3$ compounds, which are known as good thermoelectric materials at cryogenic and room temperatures, respectively. Experimental transport data and the local microscopic characterizations of the samples are presented. 1. D. J. Bergman and L. G. Fel, J. Appl. Phys. **85** 8205-8216, 1999

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