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Optimization of thermoelectric power factor in defect-engineered Bi_2Te_3 thin films JOONKI SUH, Department of Materials Science and Engineering, University of California, Berkeley, CA 94720, KIN MAN YU, Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, DEYI FU, Department of Materials Science and Engineering, University of California, Berkeley, CA 94720, XINYU LIU, Department of Physics, University of Notre Dame, Notre Dame, IN 46556, WLADEK WALUKIEWICZ, Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, JUNQIAO WU, Department of Materials Science and Engineering, University of California, Berkeley, CA 94720 — The figure-of-merit ZT, which is related to thermoelectric energy conversion, is largely dependent on the power factor ($S^2\sigma$), the electronic part of ZT. Optimizing power factor has been technically challenging due to unfavorable coupling between electrical conductivity and Seebeck coefficient, hence ZT has been commonly improved by reducing lattice thermal conductivity. In this work, we optimize the power factor with simultaneous enhancement in the in-plane electrical conductivity and Seebeck coefficient by manipulating native defects (NDs) in Bi_2Te_3 thin films using energetic alpha particles irradiation. This nontrivial optimization leads to a high power factor and potentially improves ZT by reducing the thermal conductivity. The microscopic mechanisms achieved by the multiple roles of NDs will be discussed and our work will provide a new route to improve ZT of Bi_2Te_3-related thermoelectric materials.

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