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Giant enhancements of thermoelectric power factor in strained CoAs2 thin films SUNGLAE CHO, YOOLEEMI SHIN, ANH TUAN DUONG, SOYOUNG JEKAL, University of Ulsan, JONGPHIL KIM, Korea Basic Science Institute, YOUNGHUN HWANG, S.C. HONG, University of Ulsan — The performance of a thermoelectric material is estimated via the relation of the Seebeck coefficient (S), electrical conductivity (σ) and thermal conductivity (κ) at a temperature (T), which is called the thermoelectric figure of merit, ZT=S2σT/κ. The achievement of a ZT above 1 is a historic mission assigned to the thermoelectric community. To date, the majority of research has focused on increasing μ/κ. Heremans et al. emphasized the importance of the factor, S2n where n is a carrier density, on increasing ZT. They predicted that distortions of the electronic density of states (DOS) would induce a higher Seebeck coefficient in the thermoelectric semiconductor, resulting in an increased thermoelectric power factor (S2σ). Here, we report that thermal stress due to thermal expansion coefficient difference between Si and CoAs2 film induces structural deformation, which modify the electronic structure for high carrier mobility and high Seebeck coefficient, resulting in huge thermoelectric power factor. We observed the Seebeck coefficient of -1038 μV/K and high electron mobility of 1885 cm2/Vs in CoAs2 films grown on Si substrate, resulting in the power factor of 545 mW/K2m. Note that monoclinic CoAs2 is semiconductor with a 0.2 eV band gap.

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