Abstract Submitted
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Enhanced thermoelectric properties using modulation-doping strategy in nanocomposites[1] MONA ZEBARJADI, MIT, BO YU, ZHIFENG REN, Boston College, MILDRED DRESSELHAUS, GANG CHEN, MIT, S3TEC TEAM — We introduce the modulation-doping strategy in bulk SiGe nanostructures to improve the thermoelectric power factor. By separating carriers from their parent atoms via embedding heavily doped nanoparticles inside a host matrix, the ionized impurity scattering rate could be largely reduced, resulting in enhanced mobility. By band engineering, the carriers can spill over from nanoparticles into the host matrix, resulting in similar carrier concentrations, Fermi levels and consequently Seebeck coefficients as those of the uniform nanocomposites. In addition, nanoparticles with low thermal conductivities can further reduce the overall thermal conductivity of the sample. Combining the enhanced electrical conductivity, the reduced thermal conductivity and the unaffected Seebeck coefficient, we were able to enhance the thermoelectric properties of Ge-dilute Si95Ge5. And therefore were able to fabricate a low-cost sample with a competitive performance as those of the state of the art Si80Ge20. The fabricated modulation-doped sample has a higher figure of merit, compare to its equivalent uniform nanocomposite sample and compare to ionized impurity-doped host matrix.

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Mona Zebarjadi
MIT

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