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Thermoelectric properties of bulk nanowire-nanoparticle composites VENKATA VASIRAJU, Materials Science and Engineering Department, Texas A&M University, LANCE BROCKWAY, Artie McFerrin Department of Chemical Engineering, Texas A&M University, SREERAM VADDIRAJU, Artie McFerrin Department of Chemical Engineering, Materials Science and Engineering Department, Texas A&M University — Towards realizing highly efficient bulk thermoelectrics based on nanowire-nanoparticle composites, the effect of microstructure and composition on thermoelectric properties of an illustrative composite system composed of copper nanoparticles and zinc phosphide (Zn_3P_2) nanowires is studied. Here, the intent is to extend high efficiencies achieved in individual nanowire devices to bulk nanowire assemblies. To study these effects of microstructure, thermoelectric performances of compositionally non-uniform copper nanoparticle- unfucntionalized Zn_3P_2 nanowire pellets (composite-I) were compared against those of compositionally uniform copper nanoparticle-benzenedithiol functionalized Zn_3P_2 nanowire pellets (composite-II). These results indicated that compositional non-uniformity, coupled with copper doping of Zn_3P_2 nanowires, offers more room for optimizing the thermoelectric performances of the composites. Overall, a high thermoelectric figure of merit of 0.23 at 770K was achieved in composite-I. This is two orders of magnitude higher than any achieved to date in Zn_3P_2 system. This study indicates that tuning the microstructures and composition of materials is a route for enhancing their thermoelectric efficiencies.

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