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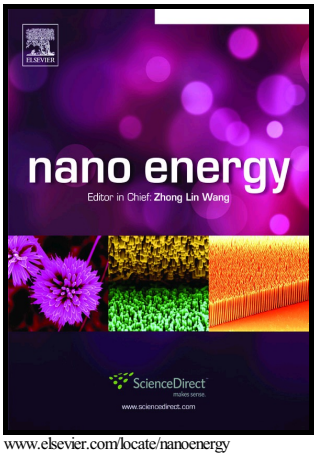

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Abstract

Copper sulfide has received wide attention as a potential thermoelectric material with high performance and abundant resource. While the liquid-like Cu ions play an important role for the low κ_L and high *ZT* values, grain-boundary engineering is needed to further enhance the phonon scattering and the thermal stability of $Cu_{2-x}S$. Here, we introduced the 3D graphene heterointerface into the $Cu_{2-x}S$ matrix by a facile technique combining mechanical alloying (MA) and spark plasma sintering (SPS). A significant *ZT* enhancement was realized with the highest *ZT* up to 1.56 and a high power factor of 1197 $\mu W\ m^{-1}K^{-2}$ at 873 K in the sample with 0.75wt% graphene. Additionally, the composite showed excellent reproducibility of *PF* after five cycles testing from room temperature to 873 K, which confirmed the practical application potentiality of this composite.

Graphical abstract

The 3D graphene network is introduced into the $Cu_{2-x}S$ matrix by a facile technique, leading to a significant ZT enhancement with the highest ZT up to 1.56 and a high PF of 1197 $\mu W\ m^{-1}K^{-2}$ at 873 K achieved for the sample with 0.75wt% graphene.