Rational design of nanocarbon materials for enhanced thermoelectric performance

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As the practical demand for flexible power-conversion devices increases, the development of high-performance alternatives to brittle inorganic thermoelectric (TE) materials is essential. Organic polymers, nano-carbons, and their hybrid materials have been investigated as possible alternatives for flexible TE materials due to their well-known advantages including flexibility, light-weight, low cost, easy processability, and scalability. Among them, nano-carbon materials and their composites have great potential for use in flexible TE materials because of their high electrical conductivities and controllable Seebeck coefficients (or thermopower). Here, we show the rationally designed flexible TE materials based on nano-carbons with excellent TE performance which is due to controlled carrier mobility. The developed TE system shows the maximum power density of 10.85 and 697 uW/g at temperature differences of 5 and 40 K, respectively. We believe that the strategy proposed here to improve the performance of flexible thermoelectric materials by controlling the carrier mobility shows a great potential for the preparation of flexible/or wearable power conversion devices.