Advancing Thermal Energy Harvesting Efficiency through Nanoengineered Thermoelectric Materials

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Thermal energy harvesting has emerged as a promising avenue for sustainable energy generation, particularly in the field of thermoelectric materials. In recent years, nanoengineering techniques have revolutionized the design and performance of thermoelectric materials, offering unprecedented opportunities for enhancing their energy conversion efficiency. Our research focuses on exploring advancements in nanoengineering strategies applied to thermoelectric materials by manipulating materials' structures and properties at the nanoscale. The key approaches in this regard include alloying, doping, hybridization, nanostructuring, and severe plastic deformation, which enable precise control over charge carrier transport and phonon scattering phenomena. By tailoring point, surface, and volume defects, nanoengineered thermoelectric materials can exhibit enhanced thermoelectric efficiency and improved thermal energy harvesting. This talk provides insights into the underlying mechanisms and potential applications of nanoengineered thermoelectric materials, shedding light on the future prospects of this transformative field for waste heat recovery and utilization in various industrial applications.