

Electronic Supplementary Information

Novel multilayer composite structured thermoelectric module with high output power

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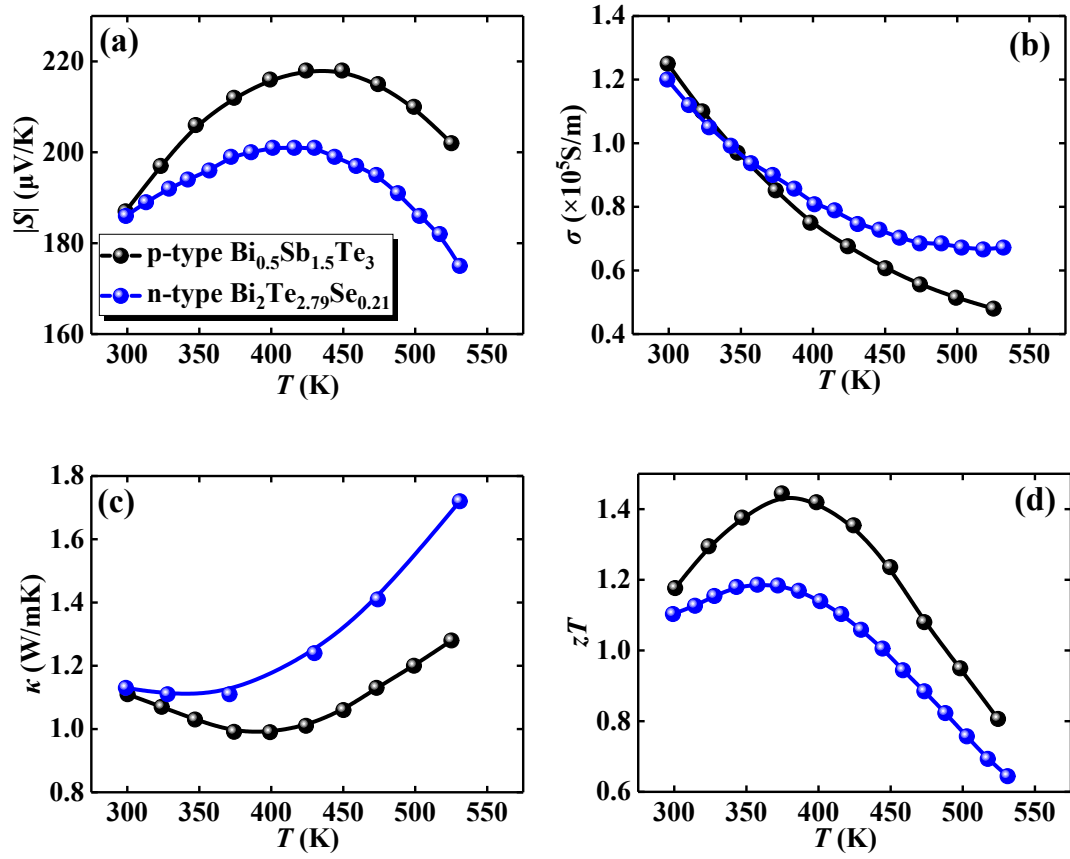


Figure S1. The temperature dependence of (a) electrical conductivity, (b) Seebeck coefficient, (c) thermal conductivity and (d) figure of merit for n-type $\text{Bi}_2\text{Te}_{2.79}\text{Se}_{0.21}$ ¹ and p-type $\text{Bi}_{0.5}\text{Sb}_{1.5}\text{Te}_3$ ².

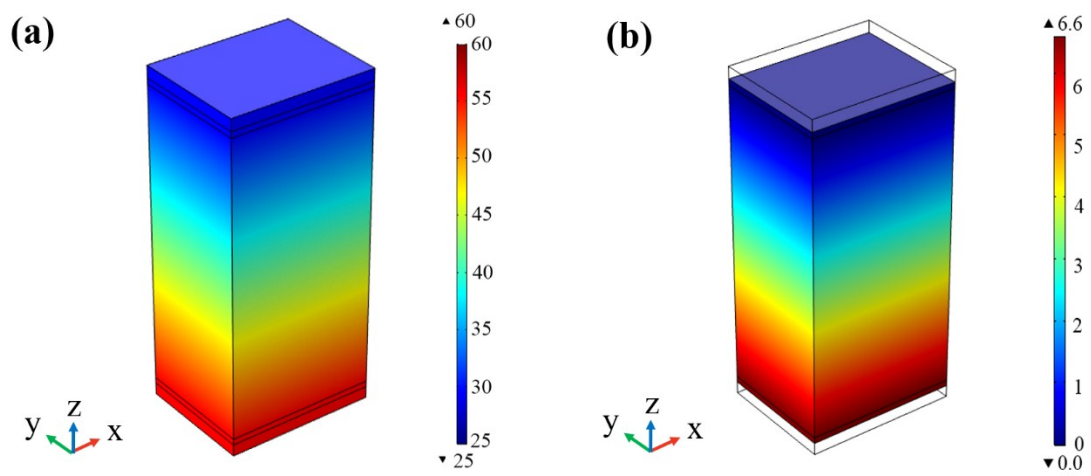


Figure S2. The (a) temperature and (b) electric potential distributions for the n-type traditional single-leg thermoelectric module at $\Delta T = 35$ °C.

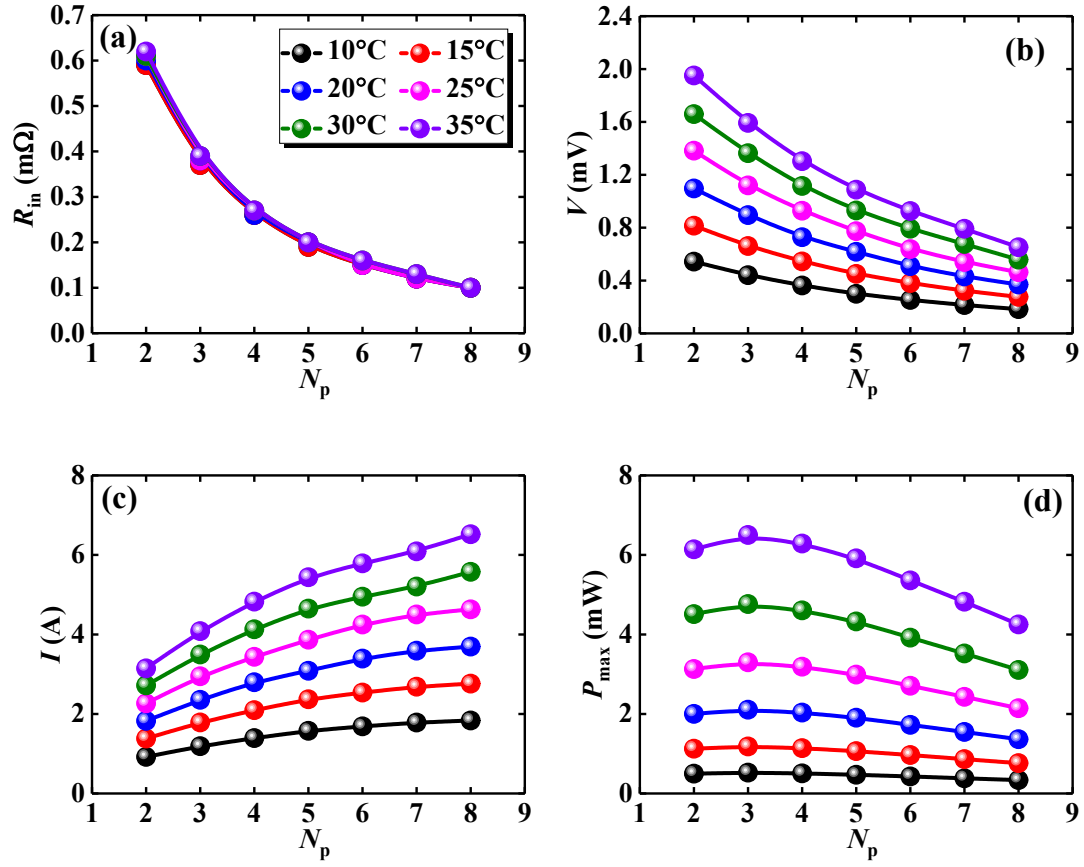


Figure S3. (a) The inner resistance, (b) output voltage, (c) working current and (d) maximum output power of the p-type single-leg multilayer composite thermoelectric module (MCTEM) as a function of the N_p under different ΔT s.

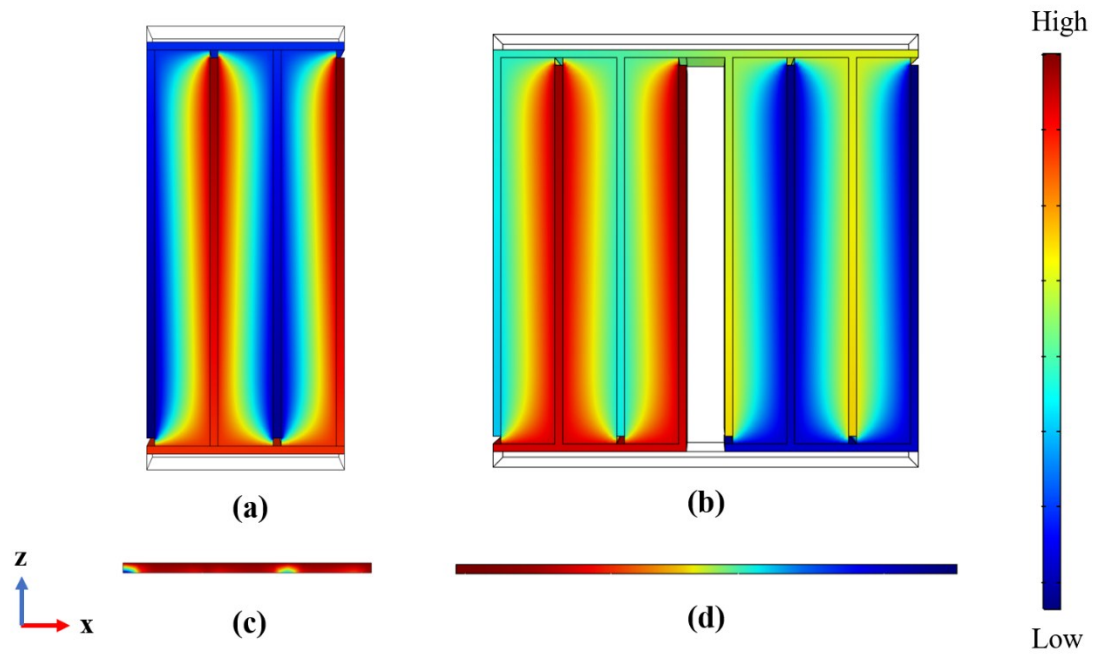


Figure S4. The electric potential distributions for (a) n-type single-leg MCTEM, (b) π -type MCTEM, (c) cold-side external electrode of n-type single-leg MCTEM and (d) cold-side external electrode of π -type MCTEM at matched load condition when ΔT is 35 °C.

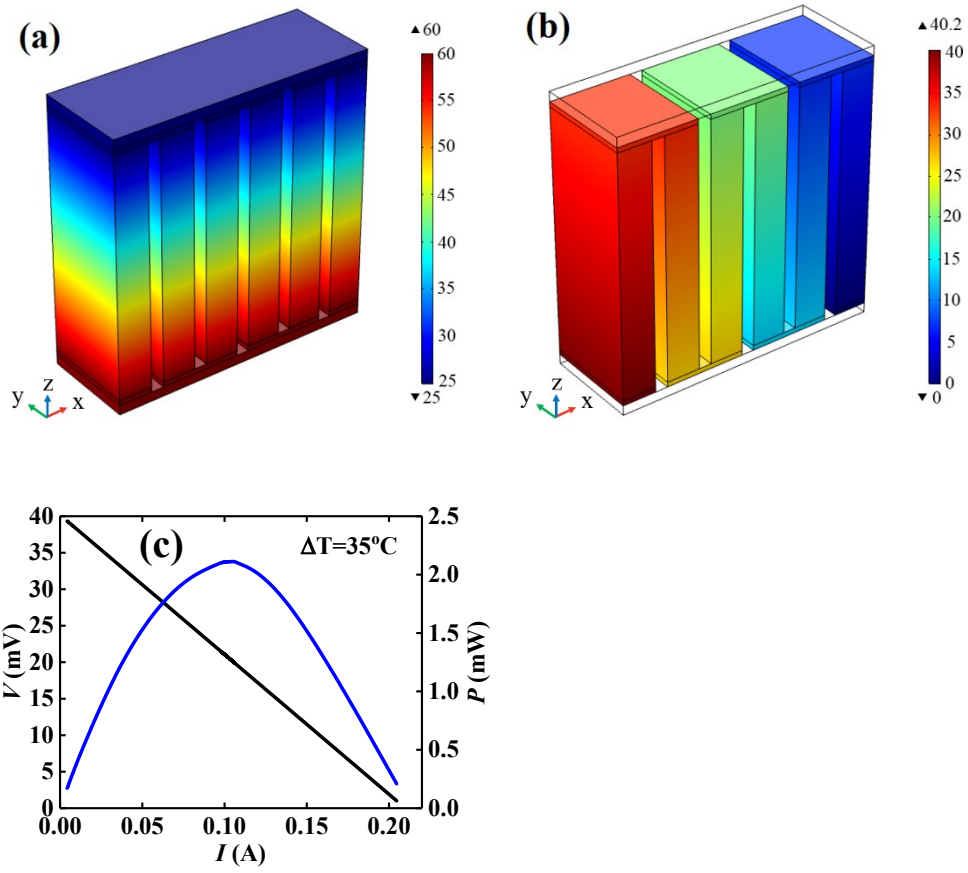


Figure S5. The (a) temperature and (b) voltage distributions of the traditional module with 3 p-n couples under open-circuit condition when ΔT is 35°C . (c) The output voltage and output power as a function of working current at $\Delta T = 35^\circ\text{C}$.

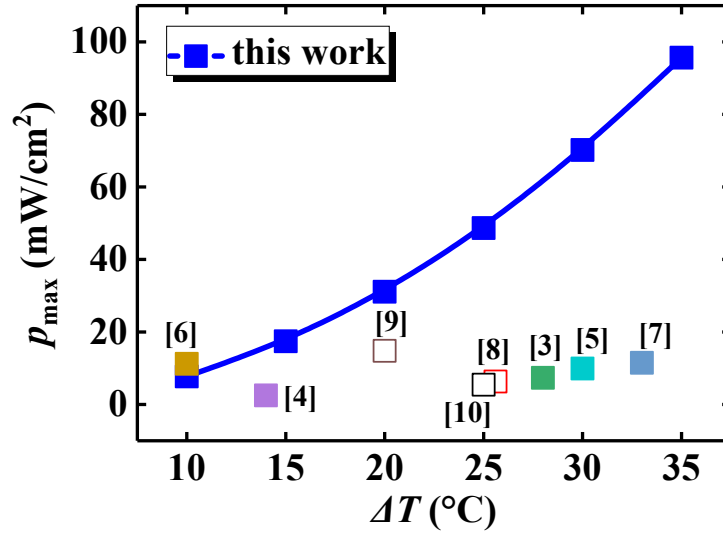


Figure S6. Maximum output power density as a function of ΔT for the π -type MCTEM and previously reported modules. The data marked by solid and open symbols are obtained from experimental³⁻⁷ and theoretical articles⁸⁻¹⁰, respectively.

Table S1. Physical properties of Ag and Al₂O₃

	C_p (J/kgK)	ρ (kg/m ³)	σ ($\times 10^6$ S/m)	κ (W/mK)
Ag	384	8960	58.1	401
Al ₂ O ₃	730	3965	0	35

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