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PERFORMANCE ANALYSIS OF NANOSCALE-GAP THERMOPHOTOVOLTAIC ENERGY CONVERSION DEVICES

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SUMMARY: The performance characteristics of nanoscale-gap thermophotovoltaic (nano-TPV) power generators are investigated via a coupled near-field thermal radiation, charge and heat transport formulation. A nano-TPV device consisting of a tungsten radiator, maintained at 2000 K, and cells made of indium gallium antimonide is considered; the thermal management system is modeled assuming a convective boundary with a fluid temperature fixed at 293 K. Results reveal that in order to maintain the cell at room temperature, a heat transfer coefficient as high as 10^5 $Wm^{-2}K^{-1}$ is required for nanometer-size vacuum gaps. In future studies, near-field radiation spectral conditions leading to optimal performance characteristics of the device will be investigated.