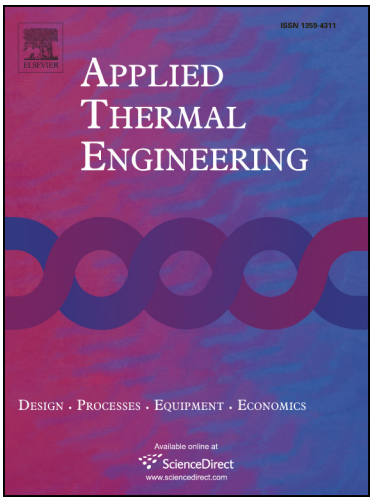


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# Performance comparison of single- and multi-stage onboard thermoelectric generators and stage number optimization at a large temperature difference

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## Abstract

Thermoelectric generator (TEG) is a possible technology of electricity generation for hypersonic vehicles. In this article, a TEG model with variable stage numbers considering the flow and heat transfer process of heat source and cold source, has been developed to compare the performances of single- and multi-stage TEGs at large temperature differences. The thermal resistances of the channel walls and ceramic plate have also been taken into account. The results indicate that the thermal resistance of ceramic plate has a weak influence on the thermoelectric performance. At a constant stage height, the thermoelectric performance with different stage number is strongly influenced by the geometry factor. When the inlet temperature of heat source is at normal (below 800 K), the single-stage thermoelectric generator has a higher maximum power density and corresponding conversion efficiency than the multi-stage TEG with the same total height of thermoelectric module. However, if the inlet temperature of heat source is higher (above 800 K), the multi-stage configuration shows a better thermoelectric performance and the optimal stage number varies with inlet temperature. In a word, the multi-stage TEGs have significant advantages over single-stage TEG at the large temperature differences (over 500 K).

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Keywords: thermoelectric generator; single-stage; multi-stage; electricity generation; hypersonic vehicles; large temperature difference.