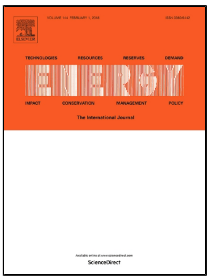
Accepted Manuscript



Numerical simulation on thermoelectric and mechanical performance of annular thermoelectric generator

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PII:	S0360-5442(18)30358-X
DOI:	10.1016/j.energy.2018.02.124
Reference:	EGY 12424
To appear in:	*Energy*
Received Date:	16 November 2017
Revised Date:	25 January 2018
Accepted Date:	21 February 2018

Please cite this article as: Shifa Fan, Yuanwen Gao, Numerical simulation on thermoelectric and mechanical performance of annular thermoelectric generator, *Energy* (2018), doi: 10.1016/j.energy.2018.02.124

Numerical simulation on thermoelectric and mechanical performance of annular thermoelectric generator

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Abstract: In this paper, a three dimensional finite element model of annular thermoelectric devices is established to optimize the geometric dimensions and the number of thermocouples for the enhancement of the thermoelectric performance and mechanical reliability. The influences of geometric dimensions and the number of the thermocouples on the thermoelectric performance and the mechanical reliability of annular thermoelectric generators are investigated, respectively. The numerical results indicate that with the increasing the angle ratio of the thermoelectric leg, the maximum von Mises stress in the legs of thermocouples decreases first and then increases, and the thermoelectric performance of the annular thermocouple can be significantly improved. In addition, increasing the length of legs of thermocouples would reduce the thermoelectric performance, but improve the mechanical reliability of annular thermocouples. For the whole annular thermoelectric generator, there exists different optimal number of thermocouples to enhance the thermoelectric performance for different external resistance. The number of thermocouples has little influence on the maximum von Mises stress in the legs of annular thermoelectric generators. Finally, the optimal geometric dimensions of the annular thermoelectric generator with high thermoelectric and mechanical performance are also discussed. These results can provide some guidance for the optimization design of annular thermoelectric generators.

Key word: the geometric dimensions, the thermoelectric performance, the mechanical reliability, annular thermoelectric generator

Nomenclature

$\mathbf{a}$	vector of thermal expansion coefficient, K^{-1}