

发电

太阳能热气流透平发电系统数值模拟

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摘要

太阳能热气流发电技术是目前国际太阳能研究领域的一个热点之一,但对负载条件下太阳能热气流发电系统的研究并不多。该文将整个太阳能热气流发电系统分成集热棚、烟囱和透平3个区域,分别建立各个区域的传热与流动数学模型。以西班牙试验电站模型为实例进行了数值模拟。计算结果表明,系统的最大输出功率略大于50 kW,与西班牙电站模型的额定功率相近,烟囱出口参数随透平转速的变化与自然对流原理相符,证明该文方法的正确性。此外,对MW级太阳能热气流发电系统进行了透平设计与计算,计算结果表明,系统输出功率超过10 MW。该文数值方法和设计方案为大规模太阳能热气流发电系统的设计和应用提供参考。

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Numerical Simulation of the Solar Chimney Power Plant Systems With Turbine

Wei liu

Abstract

Solar chimney power plant is one of the hotspots in the solar energy research of the world in the current time, but there is few study on the solar chimney power plant systems coupled with turbine. In this paper the whole system has been divided into three regions: the collector, the chimney and the turbine, and different mathematical models for heat transfer and flow have been set up for these regions. Using the solar chimney prototype in Manzanares, Spain, as a practical example, numerical simulation results show that the maximum output power of the system a little higher than 50 kW, which shows great agreement with the prototype model. In addition, the effect of the rotate speed of the turbine on the outlet parameters of the chimney is in accord with the principle of natural convection of the systems, which shows that the validity of the method advanced by the author. Later, design and simulation of MW-graded solar chimney power plant system with turbine have been carried out, and the numerical simulation results show that the output power of the system surpasses 10 MW. The methods numerical simulation and design in this paper present a guidance to the design and application of large-scale solar chimney power plant system.

Key words [Solar chimney power plant system](#) [Natural convection](#) [Turbine](#) [Output power](#) [efficiency](#)

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