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反应堆工程

高温气冷堆氦气透平直接循环的Exergy分析

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摘要 针对100 MW电功率的氦气透平直接循环的设计，对循环各个部件分别进行了热力学第一和第二定律分析。给出了各个部件的输入和产出Exergy公式，计算了Exergy损失分布表，并和按照传统分析方法分析的结果进行了比较。结果表明，一半以上的Exergy损失发生在堆芯部分，而由预冷器、压气机和间冷器组成的压缩系统所占Exergy损失比重，比按照第一定律计算的能量损失份额结果小的多；循环Exergy损失主要原因是能量形式的转换和不可逆换热。系统Exergy效率略高于热效率。

关键词 热力学分析 Exergy分析 高温气冷堆 布雷登循环 Exergy损失

分类号

Exergy Analysis of Gas Turbine Combined 100 MW HTGR

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Abstract According to the design of 100MWe HTGR coupled with gas turbine, the energy and exergy analysis were done for each part of the cycle, and inlet and outlet exergies of those parts were calculated. And the exergy loss distribution and exergy loss ratio of each sub-process were quantified and compared with the results of energy analysis done by other papers. The results show that more than a half of the exergy loss takes place inside the reactor core, while the low pressure compressor (LPC), the high pressure compressor (HPC) and the intercooler were denoted by compress system together, play a much smaller role in the contribution of exergy losses than the results in the energy analysis. The exergy loss of the cycle was mainly due to the energy conversion and irreversible heat exchange. The total energy efficiency of the cycle is quite high, and the exergy efficiency is higher.

Key words thermal analysis _ exergy analysis _ high temperature gas-cooled reactor _ Brayton cycle _ exergy loss

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