

热力学

混合制冷剂循环的级数对制冷性能的影响

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摘要

混合制冷剂制冷循环可以提高制冷系统的效率, 广泛应用于天然气液化领域。混合制冷剂的循环级数对制冷性能影响很大。针对不同级数的混合制冷剂循环进行热力学分析, 建立了流程中主要设备的热力学模型, 模拟计算了采用不同级数的混合制冷剂循环的天然气液化流程, 得到不同级数的制冷循环的主要参数: 制冷压缩机的功耗、制冷系数和火用效率。结果表明, 制冷循环的级数增加, 制冷系统的功耗降低, 制冷系数和火用效率增加, 但是级数增加对制冷性能的影响减小。制冷循环的级数增加会增加流程的复杂性, 降低可操作性, 不同规模的制冷系统的最优级数不同, 规模越大, 最优级数就越多。

关键词

[混合制冷剂循环](#) [循环级数](#) [热力学模型](#) [流程模拟](#)

分类号

Effect of number of stages of mixed refrigerant cycle on refrigeration performance

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Abstract

Mixed refrigerant cycles can improve refrigeration efficiency, and are used widely in natural gas liquefaction systems. The effect of mixed refrigerant cycle (MRC) stages on refrigeration performance is significant. Thermodynamics models of the main pieces of equipments in the MRC were built. Natural gas liquefaction processes with MRC were simulated. Most of the process parameters, including shaft power of compressors, refrigeration efficiency and exergy efficiency of different numbers of stages of MRC were obtained. With increasing number of stages of MRC, the shaft power of compressors decreased, while the refrigerant efficiency and exergy efficiency increased. But the rate of decrease and increase declined. Multi-stage cycles made the process configuration complex and operation difficult. Different sizes of refrigeration systems had different optimum number of stages. The larger the size of refrigeration system, the greater the number of stages. A balance must be made between energy efficiency and complexity.

Key words

[mixed refrigerant cycle](#) [number of stages](#) [thermodynamics model](#) [process simulation](#)

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