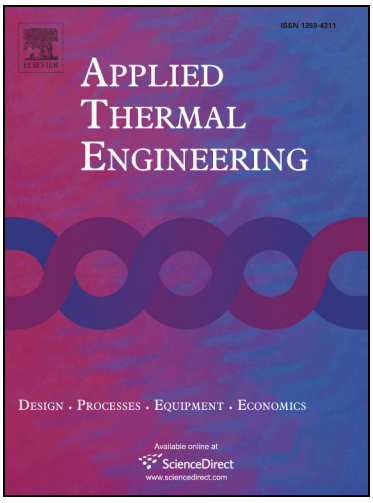

Research Paper

Advanced Exergy Analysis of a Carbon Dioxide Ammonia Cascade Refrigeration System

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Advanced Exergy Analysis of a Carbon Dioxide Ammonia Cascade Refrigeration System

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Abstract

In the present research study, a cascade NH_3/CO_2 refrigeration system is modeled and comprehensively assessed. Engineering Equation Solver (EES) as a potential tool is used for the simulation purpose. In order to validate the simulation code, the exergy destruction and COP results of the modeling is compared with an experimental data from the literature. In addition, advanced exergy analysis is applied to the system in order to determine the magnitude and location of the endogenous/exogenous and avoidable/unavoidable exergy destruction rates. The results of the advanced exergy analysis provide a very good insight for thermal engineers for system design, analysis and assessment of energy systems. The results identify that the proposed system has significant potential for efficiency improvement. The results of the advanced exergy analysis suggests that CO_2-Throtteling valve, CO_2-compressor and cascade heat exchanger are the components where improvements are necessary while conventional exergy analysis cannot provide such recommendations.

In addition, advanced exergy analysis results indicate that improvement of the components has the ability to improve the system efficiency for about 42.13%. while this improvement for exergy destruction rate is 23.81 kW.