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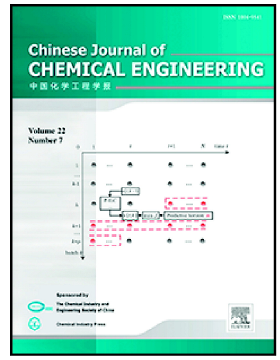

Design of Heat Exchanger Network Based on Entransy Theory

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Design of Heat Exchanger Network Based on Entransy Theory☆

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Abstract: The heat exchanger network (HEN) synthesis problem based on entransy theory is analyzed. According to the characteristics of entransy representation of thermal potential energy, the entransy dissipation represents the irreversibility of the heat transfer process, the temperature difference determines the entransy dissipation, and four HEN design steps based on entransy theory are put forward. Show how it is possible to set energy targets based on entransy and achieve them with a network of heat exchangers by an example of heat exchanger network design for four streams. In order to verify the correctness of the heat exchanger networks design method based on entransy theory, the synthesis of the HEN for the diesel hydrogenation unit is studied. Using the heat exchange networks design method based on entransy theory, the HEN obtained is consistent with energy targets. The entransy transfer efficiency of HEN based on entransy theory is 92.29%, higher than the entransy transfer efficiency of the maximum heat recovery network based on pinch technology.

Key words: process systems; heat exchanger network synthesis; heat transfer; entransy; energy target; pinch

1. Introduction

HEN is an important part of energy recovery in petrochemical industry. It is of great significance to save energy and improve energy efficiency in the process industry with high energy consumption. Pinch technology is well-established method for heat exchanger network synthesis. It not only gets the optimal design for heat exchanger network, but also obtain ideal HEN revamping for old unit. At present, the pinch design method is widely used in computer software [1,2], chemical production equipment [3,4], energy transportation system [5,6], safety and environmental management [7,8], *etc*.

In the HEN, the heat exchange process between the cold and hot streams is irreversible. The ratio of effective use of heat and total heat input in the system is defined as the thermal efficiency of the system, which further describes the extent of the effective utilization of heat. The pinch design method can calculate the heat conservation in the heat transfer process. But it cannot calculate the thermal efficiency of the HEN. Therefore, other physical quantities are needed to define for calculating the efficiency of the heat transfer process. Guo *et al*. [9] introduced a new