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Summary

One of the fundamental problems in energy efficiency for process sites is a large amount of energy that is lost in the form of low-grade waste heat. Ways in which the heat recovery can be improved by more efficient heat transfer have been investigated. Pan et al. (2011) firstly proposed a novel method to solve small scale HEN retrofit problems with intensified heat transfer techniques. They demonstrated that the new approach was able to provide realistic and practical solutions for debottlenecking of HEN with systematic use of intensified heat transfer. This leads to significant energy saving without any structural modifications of heat recovery system configuration. Later, this method has been developed for large scale problems (Pan et al, 2012), and HEN retrofit with different types of intensified techniques (Pan et al, 2013a), where suitable exchangers can be selected for enhancement by implementing one or more intensification techniques to increase the whole network energy recovery within very low retrofit cost. To combine the advantages of intensification and the conventional retrofit methods, Pan et al. (2013b) also successfully found valid retrofitted structures for retrofitting HEN with heat transfer intensification, which can achieve significant energy saving without expensive cost from too many modifications.

In particular the use of heat transfer enhancement technology has been investigated. If one of the film coefficients in a heat recovery operation is controlling, a more effective unit will result if either a greater surface area is presented to the controlling fluid e.g. by the use of extended-surface tubes, or the controlling film transfer coefficient is increased through the use of an enhancement technique. It has become clear through the research that techniques for enhancing the performance of the transfer equipment will only be effective if the heat transfer coefficient to be enhanced constitutes at least 50% of the total resistance to the heat transfer operation. Based on the analysis of detailed performances for different intensification techniques, it is possible to consider HEN retrofit problems in most practical situations, such as multiple tube passes and shell passes, exchanger pressure drops, and complex chemical process.

References:

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