Multi-Stream Heat Exchangers

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PROPOSAL

The production of cryogenic temperatures in the gas processing and petrochemical industries often involve transfer of thermal energy among three or more fluids or fluid streams. Extensive use of multi-stream heat exchangers are found in cryogenics and chemical processing units, such as air separation systems, helium-air separation units, purification and liquefaction of hydrogen, ammonia gas synthesis and others [1]. The reasons for bringing more than two fluid streams into thermal contact might be different in different applications. For example, chemical processes carried out at low temperature are dominated by requirements for very small temperature differences between streams exchanging heat because of the very high cost associated with compressor power to achieve the desired cryogenic temperatures. This led to the development of heat exchangers that are highly compact, and this is associated with a large number of flow passages for streams. The number of flowing streams in the exchanger is set by the process as well as by the flow rate and terminal conditions. Compact multi-fluid heat exchangers can result in significant savings in overall costs and space. Analysis of multi-stream heat exchangers inclusive of application of FEM for the analysis has been dealt with in considerable detail in the literature [2, 3, 4 and 5].

In this symposium, analysis of multi-stream heat exchangers will be discussed with reference to effectiveness definitions and evaluation; generation of $j$ and $f$ data, the effect of degradation parameters such as ambient heat-in-leak, longitudinal wall conduction, fluid property variations, etc; the effect of temperature crosses, flow and temperature non-uniformity on the heat exchanger performance.

REFERENCES