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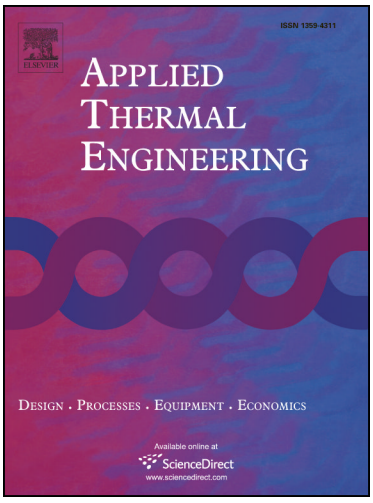

Numerical study on the condensation flow and heat transfer characteristics of hydrocarbon mixtures inside the tubes of liquefied natural gas coil-wound heat exchangers

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Numerical study on the condensation flow and heat transfer characteristics of hydrocarbon mixtures inside the tubes of liquefied natural gas coil-wound heat exchangers

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Abstract: Coil-wound heat exchangers (CWHEs) have been widely used in natural gas liquefaction plants nowadays. But few studies on the condensation heat transfer and frictional pressure drop of mixed hydrocarbon refrigerants inside the tubes of CWHEs have been conducted under practical conditions. In this study, numerical simulations were carried out to investigate the condensation flow and heat transfer characteristics of mixed hydrocarbon refrigerants inside the tubes of liquefied natural gas (LNG) CWHEs under practical operating conditions. A combinational numerical method based on computational fluid dynamics (CFD) simulation and modified Silver method was proposed to predict the condensation heat transfer coefficients of mixtures. The numerical results showed good agreement with experimental data and calculation results by the empirical correlation in the literature. The relative errors of void fraction, heat transfer coefficient and frictional pressure drop were predicted within ±5%, ±15% and ±15% respectively. The simulation results indicated that the heat transfer coefficients of mixed refrigerants varied slightly with the increase of vapor quality, but significantly with the increase of mass flux. And the frictional pressure drop increased with the increase of both vapor quality and mass flux. This study is instructive to the design and optimization of CWHEs used for natural gas liquefaction process.

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