

反应堆工程

自然循环换热器壳侧传热及流动的数值模拟

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摘要 为分析换热器的求解模型和内部结构的不同对传热和流动特性的影响, 用等效自然循环换热器的模型进行多种变换。用Fluent软件对等效模型进行非稳态数值模拟, 研究其传热和流动特性。通过比较分析不同模型的温度场和流场的变化, 对该换热器的传热过程和自然对流情况有较深刻的认识。结果表明: 自然循环换热器的传热管内外温差较大, 且流动较复杂, 选用湍流模型计算更为合理; 传热管位置的不对称性, 引起左右两侧传热和流动的不对称性, 使得流体相互影响, 增强了自然对流作用; 传热管的形状由直管变为C型弯管, 结构的复杂性在一定程度上增强了流体温度分布和流动的不规则性, 使得湍流强度增加, 致使换热效果得到改善。

关键词 [换热器](#) [非稳态数值模拟](#) [自然对流](#)

分类号

Numerical Simulation of Shell-Side Heat Transfer and Flow of Natural Circulation Heat Exchanger

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Abstract In order to analyze the influence on the heat transfer and flow characteristics of the heat exchanger model of different solving models and structures, a variety of transformation to the model equivalent for the heat exchanger was studied. In this paper, Fluent software was used to simulate the temperature-field and flow-field of the equivalent model, and investigate its heat-transferring and flow characteristics. Through comparative analysis of the distribution of temperature-field and flow-field for different models, the heat-transferring process and natural convection situation of heat exchanger were deeply understood. The results show that the temperature difference between the inside and outside of the natural circulation heat exchanger tubes is larger and the flow is more complex, so the turbulence model is the more reasonable choice. Asymmetry of tubes position makes the flow and heat transfer of the fluid on both sides to be dissymmetrical and makes the fluid interaction, and increases the role of natural convection. The complex structure of heat exchanger makes the flow and heat transfer of the fluid on both sides to be irregular to some extent when straight tubes into C-bent are transformed, and all these make the turbulence intensity increase and improve the effect of heat transfer.

Key words [heat exchanger](#) [unsteady](#) [numerical simulation](#) [natural convection](#)

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