论文

自然通风湿式冷却塔传热传质的三维数值分析

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摘要：

基于CFD软件Fluent和传热传质理论,建立了自然通风逆流湿式冷却塔空气三维运动控制方程、液相冷却水运动控制方程以及气水两相间传热传质的理论模型.采用标准k-ε湍流模型进行应力封闭,对塔内传热传质过程进行了三维数值计算.计算分析了塔内外空气的速度场、温度场和含湿量场,给出了塔内冷却水温度分布场,指出塔内雨区外侧部分区域空气和冷却水温度均低于环境干球温度,并指出进风口上沿存在纵向漩涡影响气水两相间的局部传热传质强度.计算了塔内各区冷却水蒸发量,给出塔内不同高度处淋水密度的径向分布曲线和塔内传热传质区的气水比分布场,指出传热传质主要发生在填料区.

关键词： 冷却塔 传热传质 两相流 数值分析

Three dimensional numerical analyses of heat and mass transfer in a wet cooling tower

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Abstract:

Abstract: Based on CFD code FLUENT and heat and mass transfer theory, the governing equations of air and water and the theory model of heat and mass transfer between air and water were set up for a natural draft counter flow wet cooling tower (NDWCT). The models of forces brought to each phase were set up resorting to discrete phase model and experimental correlation. Adopting the standard k-ε model to close the Reynolds average equations, the three dimensional heat and mass transfer process in NDWCT was simulated and analyzed. The fields of air velocity, temperature and moisture content show that there are regions where the temperatures of air and cooling water are less than the ambience dry bulb temperature in a rain zone, which also indicates that the longitudinal eddy upon the inlet has a negative effect on the local intensity of heat and mass transfer. The cooling water evaporation rate in each zone was computed and investigated. The water mass flow rate radial distribution curves at different heights and the distribution field of the mass flow rate ratio of air to water were given to analyze the evaporation intensity, which indicated that heat and mass transfer mainly occurs in the fill zone.

Keywords: cooling tower heat and mass transfer two-phase flow numerical analysis

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1. 王凯,孙奉仲,赵元宾,高明,高山 .自然通风冷却塔进风口流场模型的建立及计算[J]. 山东大学学报(工学版), 2008,38(1): 13-17