

工程热物理

低质量流速优化内螺纹管的传热特性试验研究

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摘要:

在亚临界、近临界及超临界压力区, 对600 MW超临界W火焰锅炉水冷壁中垂直上升低质量流速优化内螺纹管的传热特性进行了试验研究, 得到了不同运行工况下内螺纹管的壁温分布, 分析了压力、外壁热流密度、质量流速对传热特性的影响。结果表明: 低质量流速优化内螺纹管具有良好的传热特性, 能够有效避免膜态沸腾; 在亚临界压力区, 压力与热流密度的增大以及质量流速的减小, 均会导致干涸提前发生和干涸后的壁温飞升值增大。与亚临界压力区相比, 内螺纹管在近临界压力区的传热特性变差, 随着压力的增大, 管壁温度显著升高, 发生传热恶化时的临界干度减小。在超临界压力区, 内螺纹管在拟临界点附近出现了传热强化; 压力越接近临界压力, 传热强化越明显; 压力与热流密度的增大以及质量流速的减小均会导致壁温增大。

关键词: 超临界W火焰锅炉 低质量流速 优化内螺纹管 传热特性

Experimental Investigation on Heat Transfer Characteristics of Low Mass-flux Optimized Rifled Tube

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Abstract:

Under sub-critical, near-critical and supercritical pressure, this paper experimentally investigated the heat transfer characteristics of vertical upward low mass-flux optimized rifled tube, which is applied in supercritical W-shape flame boiler. The wall temperature distribution in rifled tube was obtained and the effects of pressure, inner wall heat flux and mass flux on heat transfer characteristics was analyzed. The results illustrate that low mass-flux optimized rifled tube has good heat transfer performance and can efficiently prevent the occurrence of departure from nucleate boiling (DNB). In sub-critical pressure region, with the increase of pressure and inner wall heat flux and the decrease of mass flux, dryout occurs ahead and the wall temperature in post-dryout region increases obviously. Compared with the heat transfer characteristics of rifled tube at sub-critical pressure, that in near-critical pressure region gets worse, the wall temperature significantly rises and the critical quality decreases with increasing pressure. At supercritical pressure, heat transfer enhancement occurs in pseudo-critical enthalpy region in rifled tube; while the pressure approaches critical pressure, the heat transfer is enhanced more; the wall temperature increases with increasing pressure and heat flux and with decreasing mass flux.

Keywords: supercritical W-shape flame boiler low mass-flux optimized rifled tube heat transfer characteristics

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