

燃料气体预热温度对微燃烧器性能影响的分析 Effects of Preheating Fuel Gas to Micro-scale Flame

周俊虎 汪洋 杨卫娟 刘建忠 王智化 岑可法

浙江大学

关键词: 微燃烧 预热温度 数值模拟 性能分析

摘要: 燃料在直圆管形状的微尺度燃烧器中进行预热燃烧, 对比不同预热温度下的燃烧器工作性能, 检验强化预热对促进微燃烧稳定的效果。实验选择燃料混合气体流量为0.12、0.24、0.36 L/min, 预热温度分别为室温23℃和250、500℃。实验结果显示, 在室温, 燃料混合气体流量0.12 L/min下, 燃烧器可燃极限当量比为0.339~3.639。预热温度上升到250℃时, 可燃极限当量比范围增大到0.317~4.304。而预热温度500℃时, 可燃极限当量比范围减小为0.453~1.706。在实验中测量燃烧器壁面温度, 结合数值模拟研究内部燃烧过程。模拟结果显示, 随预热温度上升, 反应区域峰值温度上升。在流量0.24 L/min, 当量比为1, 预热温度由室温上升至500℃时, 峰值温度由1.890 K上升至2.013 K。实验结果证明适当预热可以提高反应温度, 从而抑制热熄火。The effect of preheating was investigated in a straight-tube shape micro combustor. Performances of combustor were compared under conditions with different preheating temperature. The flow rates of the fuel feed amount were 0.12, 0.24, 0.36 L/min, respectively. The preheating temperatures were environmental temperature (23℃), 250℃, 500℃, respectively. Experimental results showed that with environmental temperature and 0.12 L/min, the stability limit was 0.339~3.639. While the preheating temperature increased to 250℃, the stability limit extended to 0.317~4.304. At the preheating temperature of 500℃, the stability limit was 0.453~1.706. The temperature distribution on the combustor wall was measured, which was combined with numeric simulation to investigate the combustion process in the combustor. Simulation results indicated that the peak temperature in the reaction region increased with preheating temperature. At 0.24 L/min and stoichiometry, while the preheating temperature increased from environmental temperature to 500℃, the peak temperature increased from 1.890 to 2.013 K. It proved that the proper preheating could increase the reaction temperature, thus inhibited thermal extinction.

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