袁立公,邓宏武,徐国强,贾洲侠,李一帆.超临界压力下航空煤油RP-3壁面结焦特性对换热的影响[J].航空动力学报,2013,28(4):832~837

超临界压力下航空煤油RP-3壁面结焦特性对换热的影响

Effects of RP-3 coke deposition on heat transfer under supercritical pressure

投稿时间： 2012-05-05

DOI：

中文关键词： 超临界 航空煤油RP-3 微细管 结焦 换热

英文关键词:supercritical pressure aviation kerosene RP-3 miniature pipe coke deposition heat transfer

基金项目:国家自然科学基金(50676005)

作者	单位
袁立公	北京航空航天大学 能源与动力工程学院 航空发动机气动热力国家级重点实验室, 北京 100191
邓宏武	北京航空航天大学 能源与动力工程学院 航空发动机气动热力国家级重点实验室, 北京 100191
徐国强	北京航空航天大学 能源与动力工程学院 航空发动机气动热力国家级重点实验室, 北京 100191
贾洲侠	北京航空航天大学 能源与动力工程学院 航空发动机气动热力国家级重点实验室, 北京 100191
李一帆	北京航空航天大学 能源与动力工程学院 航空发动机气动热力国家级重点实验室, 北京 100191

中文摘要:

研究了超临界压力下航空煤油(RP-3)在微细管内流动过程中结焦对换热的影响规律.实验中系统压力保持为5MPa,燃油质量流量为3g/s.燃油溶解氧达到饱和,实验段进出口油温分别为127℃和450℃,实验时间为60min,并利用“称质法”获得煤油结焦量.结果表明:由于壁面结焦的差异使得换热特性沿实验段可分为3个区域:进口低温段的传热稳定区、结焦峰值处的传热恶化区和出口高温段的短期强化区.进口低温段结焦量较少,对换热的影响可以忽略;结焦峰值处由于其结焦迅速且量大致使管内传热热阻突增,传热系数下降36.1%故出现传热恶化;高温段出现短期强化是由于结焦微粒附着于管壁,增加了其粗糙度而导致近壁面处流体湍动能增大以及由于近壁面高温区域煤油裂解结焦而产生化学吸 热量,进而强化换热.随着时间的推移,结焦量不断增多,结焦热阻增加的效应抵消并超过以上两种因素的影响,因此又出现传热恶化.

英文摘要:

The effect of coking deposition of RP-3 on heat transfer was investigated experimentally.The fuel flowing through miniature tube was heated from 127℃ to 450℃ at 5MPa,and the mass flow rate was maintained at 3g/s.The surface coking deposition was obtained by weighting method.Test results show that the effect of coking deposition on heat transfer could be divided into three regions due to differences of deposition:stable heat transfer region at low fuel temperature,deteriorated heat transfer region at peak coking deposition position and short term enhanced heat transfer region at high fuel temperature.Due to lower fuel temperature at the entrance region,the coking deposition amount was tiny and its effect on heat transfer could be ignored.At peak coking region,heat transfer resistance increased sharply with coke deposition,heat transfer coefficiency decreased by 36.1%,and heat transfer deterioration was observed in the whole time.In addition,short term enhanced heat transfer occurred due to the roughness increase by coke particles adhered to the inner surface of the pipe and chemical heat absorption caused by cracking coke deposition.As more and more coke particles adhered,the increasing heat transfer resistance resulted in heat transfer deterioration.