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带补偿加热的GH4169间的接触热导测试研究

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Experimental Investigation of Thermal Contact Conductance Across GH4169/GH4169 Interface with Compensation Heater

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摘要

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摘要 针对航空发动机热端部件的材料特性和工作环境特点,自主研制了带有补偿加热装置的高温、高压接触热导(TCC)测试系统。设计使用纯铜作为热流计材料,使其对于热导率不明确或随温度变化较大的高温合金同样具有较好的适用性。针对航空发动机热端部件常用结构材料GH4169/GH4169在不同界面压力(60~180 MPa)和不同界面温度(150~500 ℃)下的接触热导进行了试验研究。研究结果表明采用该系统进行高温、高压条件下的接触热导试验研究是可行的,利用该测试系统得到了GH4169间的接触热导的变化规律,并分析比较了有、无补偿加热装置条件下的接触热导变化情况。

关键词: 温度补偿 航空发动机 高温合金 接触热导 接触热阻

Abstract: An experimental setup of high-temperature and high-pressure thermal contact conductance (TCC) with a compensation heater is independently developed according to the material properties and working environments of aero-engine hot-end components. A pure Cu bar is used as the heat-flow meter to measure the axial heat flux, which is also suitable for superalloys whose thermal conductivity is either unclear or exhibits great variation with temperature. An experimental investigation of TCC is conducted with pressed pairs of aero-engine hot-end component structure material GH4169/GH4169 contacts in the range of 150-500 ℃ and 60-180 MPa. The results show that the present experimental setup is feasible for the experimental investigation of high-temperature and high-pressure TCC, and the variation of the TCC across GH4169/GH4169 is obtained. Moreover, the variation of the TCC with and without a compensation heater is studied. The research results may serve as a significant reference for the prediction of aero-engine thermal properties.

Keywords: temperature compensation aero-engine superalloy thermal contact conductance thermal contact resistance

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