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温度与载荷对GH4169/5CrMnMo界面接触换热的影响

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摘要: 基于传热学基本原理建立合理简化的热接触模型。应用稳态法, 通过自制的实验设备对GH4169高温合金与5CrMnMo模具钢的界面接触换热系数进行测量。根据实验数据归纳出接触换热系数的经验计算关系式, 比较计算结果和实验结果。研究表明: 接触界面温度变化范围为240~560 °C, 接触载荷能够达到15.68 MPa; 接触换热系数随界面温度和接触载荷的增加呈现增大趋势, 但在320 °C和470 °C附近出现换热系数的极小值, 温度与载荷的作用是通过改变材料热物性及力学性能间接实现的; 经验计算关系式满足幂律关系, 引入修正系数 α 和 δ 后, 能够合理地预测接触换热系数, 计算结果与实验结果较吻合。

关键字: 界面温度; 接触载荷; 接触换热系数; 经验关系式

Effect of temperature and load on contact heat transfer between GH4169 and 5CrMnMo

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Abstract: Based on the principles of conduction heat transfer, a thermal contact model which was predigested rationally was established. Contact heat transfer coefficient between GH4169 super alloy and 5CrMnMo die steel was measured by the self-developed experiment setup using the steady state method. An empirical correlation was induced according to experimental data, and the results of calculation and experiment were compared. The results show that the interfacial temperature is 240-560 °C, the maximum contact load can reach 15.68 MPa. Contact heat transfer coefficient increases with the increase of interfacial temperature and contact load generally, but there exist minimum values near 320 °C and 470 °C. They affect contact heat transfer coefficient indirectly by varying the thermodynamics properties of materials together. Contact heat transfer coefficient can be predicted by the empirical correlation with amended coefficients α and δ , and agrees well with the experimental values.

Key words: interfacial temperature; contact load; contact heat transfer coefficient; empirical correlation

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