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基于热-结构耦合的高炉无钟炉顶阀箱疲劳寿命预测

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摘 要：根据装料设备的工作流程，确定阀箱3种最不利的载荷工况；基于热－结构耦合理论并利用有限元分析软件ANSYS研究阀箱在温度载荷和机械载荷作用下的热－结构耦合问题，得到实际工况下阀箱的温度场、应力场以及危险部位的应力谱；依据裂纹萌生和扩展理论对阀箱进行疲劳寿命预测。研究结果表明，在3种载荷工况作用下阀箱应力均低于材料的屈服强度，其安全系数为1.8~3.2，且阀箱的变形在允许范围之内，阀箱静强度及刚度满足要求；阀箱疲劳寿命大于10^7，也满足要求。

关键字：热-结构耦合分析；温度场；应力场；裂纹；疲劳寿命；预测

Fatigue life prediction of clack box of bell-less top of large blast furnace based on thermal-structural coupling

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Abstract: Based on the work flow of charging equipment, three worst work conditions of the clack box were defined. Then, based on thermal-structure coupled theory, the thermal-structure coupled of the clack box which suffered from mechanical and temperature load was analyzed using the powerful software ANSYS. The clack box's temperature field and stress field as well as the stress spectrum of danger area in actual working condition were obtained. Finally, based on crack initiation and crack extension theory, the clack box's fatigue life was predicted. The results show that the stress of clack box is lower than the yield limit of the material. The safety factor is between 1.8 and 3.2, and the distortion of clack box is in the permission scope. The static strength and stiffness satisfy the request, and the life of clack box exceeds 10^7, which meets the requirements.

Key words:thermal-structural coupled analysis; temperature field; stress field; crack; fatigue life; prediction

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