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信息科学

数字图像相关方法在WC/Cu复合材料线膨胀系数测量中的应用

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摘要： 为了提高数字图像相关曲面拟合法在实际应用中的亚像素定位精度，对曲面拟合法进行了修正，并用修正后的曲面拟合法研究了WC颗粒大小和含量对WC/Cu复合材料线膨胀系数的影响。首先，分析了曲面相关拟合法在实际应用中的测量误差来源，并对其进行了修正。然后，用粉末冶金法制备出WC/Cu复合材料，对表面制备有耐高温散斑的试件进行热膨胀实验，并利用修正后的曲面拟合法测量了不同温度下WC/Cu复合材料的热变形场。最后，通过一元二次多项式拟合建立了WC/Cu复合材料热膨胀系数真值。结果表明：修正后的曲面拟合法有效地改善了传统方法的亚像素位移在0.5像素左右位移场不连续的问题，减小了亚像素定位误差，获得了更为准确的测量数据。

关键词： Wc/Cu符合材料 数字图像相关 曲面拟合法 亚像素 线膨胀系数测量

Application of digital image correlation method in measuring linear expansion coefficient of WC/Cu Composites

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Abstract: To improve the sub-pixel registration accuracy of quadratic surface fitting method in digital image correlation, the method was corrected and the corrected quadratic surface fitting method was used to research the effect of sizes and contents of WC on the thermal expansion coefficients of WC/Cu composites. First, the measurement error sources of the quadratic surface fitting method were analyzed in a practical application. Then, WC/Cu composites were prepared by a powder metallurgy method, and thermal expansion tests of the specimen with speckles which can resistant to high temperatures were performed and thermal deformation fields of the WC/Cu Composites under different temperatures were measured by the corrected quadratic surface fitting method. Finally, the truth values of the thermal expansion coefficients were given by quadratic polynomials fitting. The experiment result indicates that corrected method effectively improves sub-pixel registration accuracy, especially reduces the displacement fluctuation around 0.5 pixels, and offers more accurate measurement results.

Keywords: WC/Cu composite digital image correlation curved surface fitting method sub-pixel linear expansion coefficient measurement

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