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现代应用光学

白光轴向色差技术用于材料动态损伤测量

彭辉^{1,2}, 李平^{1,2*}, 裴晓阳², 贺红亮², 祁美兰³

1. 北京理工大学 爆炸科学与技术国家重点实验室, 北京 100081;
2. 中国工程物理研究院 流体物理研究所 冲击波物理与爆轰物理重点实验室, 四川 绵阳 621900;
3. 武汉理工大学 理学院, 湖北 武汉 430070

摘要: 实验研究了轴向色差测试技术用于动态损伤样品截面形貌测量的可行性, 对材料动态损伤的损伤程度进行了高精度的表征与量化。首先, 采用基于白光轴向色差的表面轮廓测试技术, 对动态冲击实验“软回收”得到的样品截面进行测量; 然后, 对测试数据进行重构, 获得了样品截面二维图像和表面三维轮廓形貌。最后, 针对该测试方法获得的数据建立了损伤计算方法, 并利用该方法计算了材料的损伤量。结果表明: 该技术能对样品截面进行大范围连续测量(6.9 mm×9.999 mm), 获得样品截面清晰的三维形貌, 并且将损伤度曲线的分辨率提高到3 μm。得到的结果显示: 基于白光轴向色差的测试技术能实现材料动态损伤的大范围、高精度连续测量, 测试工作量小, 计算损伤的方法简单, 能有效地提高损伤度曲线的分辨率。

关键词: 白光干涉术 表面轮廓测量 轴向色差 动态材料损伤 量化分析

Measurement of dynamic damaged materials by white light axial chromatic aberration

PENG Hui^{1,2}, LI Ping^{1,2*}, PEI Xiao-yang², HE Hong-liang², QI Mei-lan³

1. State Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology, Beijing 100081, China;
2. National Key Laboratory of Shock Wave and Detonation Physics, Institute of Fluid Physics, China Academy of Engineering Physics, Mianyang 621900, China;
3. School of Science, Wuhan University of Technology, Wuhan 430070, China

Abstract: The feasibility of morphologic measurement for Dynamic Damaged Materials by the white light axial chromatic aberration method was explored, and the internal dynamic damage of materials was characterized and quantized precisely. First, the surface profile measurement technique based on white light axial chromatic aberration was used to measure the cross section of samples recovered softly from dynamic impact experiments. Then, the cross section image and 3D surface topography were obtained by reconstruction of the test data. Finally, based on the test data, a new method to calculate the damage of samples was established and the damage curve of the samples was calculated. The results indicate that the axial chromatic aberration measurement can measure a wide range cross section of the sample(6.9 mm×9.999 mm) without disconnection and can receive a clearly three dimensional morphology of the sample cross section. The resolution of the damage curve can be improved to 3 μm. It means that the white light axial chromatic aberration method used to measure the dynamic damage sample is effectively. It can implement a continuous measurements with large scale and high precision and show its characteristics in smaller operation, simpler calculation and higher resolution.

Keywords: White light interferometry surface profile measurement Axial Chromatic Aberration Dynamic Material Damage quantitative analysis

收稿日期 2013-04-22 修回日期 2013-06-24 网络版发布日期 2013-12-25

基金项目:

国防基础科研计划; 中国工程物理研究院科学技术发展基金

通讯作者: 彭辉

作者简介: 彭辉(1986-), 男, 重庆人, 博士研究生, 2008年于北京理工大学获得学士学位, 主要从事材料动态损伤方面的研究。

作者Email: 361145894@qq.com

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