吉林大学学报(工学版) 2008 38 (06): 1300-1304 ISSN: 1671-5497 CN: 22-1341/T

埋入光纤布拉格光栅传感器的智能碳纤维复合塑料

卢少微[1]，谢怀勤[2]，陈平[1]

1.沈阳航空工业学院 材料工程系，沈阳 110034；2.哈尔滨工业大学 材料科学与工程学院，哈尔滨 150001

收稿日期 2007-4-13 修回日期 网络版发布日期 2008-10-25 接受日期

摘要

根据弹性力学和边界条件，得出了光纤布拉格光栅（FBG）传感器应变测量值与基体材料实际应变的关系方程。通过裸光栅直埋基体材料界面传递的特征系数，可表征和计算FBG检测应变与测点实际应变的误差及修正系数。并对固化于CFRP的FBG变传感特性进行了实验研究。结果表明：FBGBragg波长对应变表现出很好的线性和重复性。用电阻应变仪对FBG传感器应变传感特性进行实验对比标定，得出了表征FBG性能的应变传感灵敏系数。FBG传感器具有优异的应变传感特性，为先进智能复合材料的研发与应用提供了依据。

关键词 复合材料 光纤布拉格光栅传感器；碳纤维复合塑料；界面传递特性；应变传感

分类号 TB33

Smart CFRP embedded with optical fiber Bragg grating sensors

LU Shao-wei[1], XIE Huai-qin[2], CHEN Ping[1]

1.Department of Materials Engineering, Shenyang Institute of Aeronautical Engineering, Shenyang 110134,China; 2.College of Materials Science and Technology, Harbin Institute of Technology, Harbin 150001,China

Abstract

The relationship between the actual strain of the substrate and the strain measured by the optical fiber Bragg grating(FBG) sensor was obtained according to elastic mechanics and boundary conditions. The error between the strain measured by FBG and the actual strain at measure point can be characterized and calculated by the interface transferring characteristic coefficients of the substrate embedded with a bare grating. The strain sensing properties of the FBG solidibied into carbon fiber reinforced plastics(CFRP) have been studied experimentally. The calibration of the strain sensing properties of FBG sensor was performed experimentally in comparison with conventional resistance wire strain gauges to get the strain sensing sensitivity coefficient of FBG sensor. Study results showed that the Bragg wavelength of FBG is characterized by good linearity a repentability with strain, and the test data of FBG are stable and rehiable. The developed FBG sensor is possessed of an excellent strain sensing performance, providing a basis for research and application of advanced smart composites.

Key words composite material fiber Bragg grating(FBG) sensor carbon fiber reinforced plastics(CFRP) interface transferring properties strain sensing

DOI:

通讯作者 卢少微 shaowei9132@sina.com