

论文

FRP-混凝土界面疲劳性能分析

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摘要:

应用红外探测技术跟踪记录了2个纤维增强聚合物复合材料(FRP)加固混凝土试件界面的疲劳损伤发展过程, 结合系列疲劳试验分析了界面的疲劳力学性能和疲劳寿命。结果显示, FRP-混凝土界面粘结区和剥离区有明显的温度差异, 应用红外探测技术可以较准确地检测界面的损伤发展状况。界面的疲劳损伤从跨中位置萌生后向一端扩展, 损伤演化可分为萌生、稳定发展和失稳发展3个阶段, 稳定发展阶段约占界面疲劳总寿命的99%左右。在界面疲劳寿命的主要阶段内界面的疲劳损伤较小, 发展缓慢, FRP应力也变化平稳, 表明加固的抗疲劳效果较好。最后给出了界面疲劳寿命的预测方法, 界面的疲劳破坏制约了FRP材料强度性能的充分利用。

关键词: 纤维增强聚合物复合材料 混凝土结构加固 界面 疲劳性能 红外检测

Analysis of FRP-concrete interfacial fatigue properties

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Abstract:

The interfacial fatigue damage behaviors of two reinforced concrete (RC) beams strengthened with fiber reinforced plastic (FRP) were recorded with the infrared detecting method, and based on a series of fatigue tests the interfacial fatigue properties and interfacial fatigue lives were studied. It is found that the infrared detecting method can be used to monitor the interfacial debonding effectively because the difference in infrared temperature between the bonding and debonding areas is obvious. The interfacial debonding initiates at the concrete cracks around the mid-span and then expands to one end of the beam, in which the process for the initiation and stable or unstable growth of the interfacial debonding has been observed with the stable phase about 99% of the total interfacial fatigue life. In the main fatigue phase, the interfacial damage is little and increases slowly; in addition FRP stress changes smoothly, showing that the interfacial fatigue properties are stable. The use of FRP high strength is restrained by the interfacial fatigue failure, and at last according to test data a prediction approach for interfacial lives is given.

Keywords: fiber reinforced polymer concrete structure reinforcement interface fatigue properties infrared detecting method

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