

基于短栅区光纤光栅传感器的油气管线腐蚀在线监测系统研究

作者：刘海锋, 王虎, 刘伟, 曹宏源, 刘波

单位：南开大学

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摘要：

基于短栅区光纤光栅传感器设计了一种油气管线腐蚀在线监测系统。对应油气管线外表面周向非线性应变，该系统可以测量油气管线腐蚀缺陷，保障管线安全运行。通过对管线圆柱型腐蚀缺陷周向应变特性及光纤光栅应变传感模型的理论分析，设计了3mm短栅区光纤光栅的应变传感阵列，并在模拟油气管道上验证了测量圆柱型缺陷表面周向非线性应变的可行性。结合波分复用、时分复用技术及光纤光栅解调系统可以组成解调 7×7 个应变及1个温度补偿共计50个光纤光栅传感器的在线监测系统。该系统已应用于中海油渤海南龙口天然气终端处理厂，监测结果表明该在线监测系统稳定可靠，是监测油气管线腐蚀状况，保障管线安全运行的一种有效可靠方法。

关键词：光纤Bragg光栅 短栅区 非线性应变 油气管线腐蚀 在线监测

Research of online monitoring system for oil or gas pipeline corrosion based on short region FBG sensors

Author's Name:

Institution:

Abstract:

In this paper, a novel online monitoring system for oil or gas pipeline corrosion based on short gate region fiber Bragg grating (FBG) sensors is designed. Corresponding to the outer surface of the circumferential nonlinear strain, it can measure the oil or gas pipeline corrosion defects to protect the security of pipeline. The strain characteristics of the cylindrical corrosion defects and FBG strain sensing model is analyzed. A 3mm short gate region optical fiber grating strain sensor array is designed and its feasibility of measuring the nonlinear strain of oil pipelines is verified in the laboratory. By employing the wavelength-division-multiplexing and time-division-multiplexing technologies, for the online monitoring system the FBG demodulation system includes of interrogation 7×7 strain and one temperature compensation around 50 sensors which has been applied to the CNOOC Bohai South Longkou natural gas terminal treatment plant. The monitoring results show that the short gate region FBG sensors can provide a stable, effective and reliable method for monitoring the oil or gas pipeline corrosions. Also it can ensure the security of pipeline operation.

Keywords: fiber Bragg grating; short gate region; nonlinear strain; oil or gas pipeline corrosion; online monitoring;

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