Structural Surface Crack Monitoring Method Based on Electrical Potential Technique and Modern Surface Technology

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Received July 15, 2010; revised February 28, 2011; accepted March 14, 2011; published electronically March 18, 2011

Abstract: Crack monitoring plays a great role in modern structural health monitoring, however, most of the conventional crack inspections have disadvantages in terms of the accuracy, expense, reliability, durability and level of instrumentation required. Thus, development of a simple and reliable crack inspection technique that allows continuous monitoring has been desired. In this paper, electrical potential technique and modern surface technology are employed together to develop a new structural surface crack monitoring method. A special crack monitoring coating sensor based on electrical potential technique was deposited on the hot spot of the structure by modern surface technology. The sensor consists of three layers: the isolated layer, the sensing layer and the protective layer. The isolated layer is prepared by anodic oxidation technology, the sensing layer is made of ion plated copper, and the protective layer is made of silicone. The thickness of each layer is at micrometer magnitude. The electrical conductivity of the sensor is very stable, and the fatigue performance of the specimen with or without coating sensor is nearly unchanged. The crack monitoring experiment result shows that there are two sudden rises of the coating sensor electrical potential values, corresponding to different stages of the crack initiation and propagation. Since the width of the surface coating sensor is only 0.5 mm, this crack monitoring sensor can detect the propagation of cracks less than 0.5 mm long. The method proposed takes the simplicity of electrical potential technique and can monitor surface crack of nearly all kinds of structures precisely. The results of this paper may form the basis of a new crack monitoring system.

Key words: crack monitoring, electrical potential technique, surface technology, coating sensor, LY12-CZ aluminum alloy

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This project is supported by National Hi-tech Research and Development Program of China (863 Program, Grant No. 2009AA03Z103), and Scientific Research Foundation for the Returned Overseas Chinese Scholars of Ministry of Education of China (Grant No. [2006]331).

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