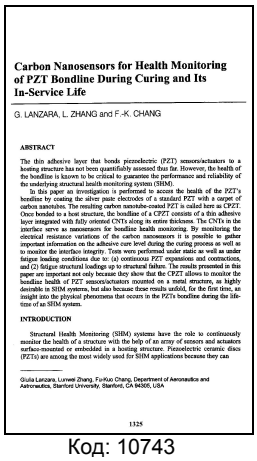

Carbon Nanosensors for Health Monitoring of PZT Bondline During Curing and Its In-Service Life

G. LANZARA, L. ZHANG and F.-K. CHANG

ABSTRACT

The thin adhesive layer that bonds piezoelectric (PZT) sensors/actuators to a hosting structure has not been quantifiably assessed thus far. However, the health of the bondline is known to be critical to guarantee the performance and reliability of the underlying structural health monitoring system (SHM).

In this paper an investigation is performed to access the health of the PZT's bondline by coating the silver paste electrodes of a standard PZT with a carpet of carbon nanotubes. The resulting carbon nanotube-coated PZT is called here as CPZT. Once bonded to a host structure, the bondline of a CPZT consists of a thin adhesive layer integrated with fully oriented CNTs along its entire thickness. The CNTs in the interface serve as nanosensors for bondline health monitoring. By monitoring the electrical resistance variations of the carbon nanosensors it is possible to gather important information on the adhesive cure level during the curing process as well as to monitor the interface integrity. Tests were performed under static as well as under fatigue loading conditions due to: (a) continuous PZT expansions and contractions, and (2) fatigue structural loadings up to structural failure. The results presented in this paper are important not only because they show that the CPZT allows to monitor the bondline health of PZT sensors/actuators mounted on a metal structure, as highly desirable in SHM systems, but also because these results unfold, for the first time, an insight into the physical phenomena that occurs in the PZTs bondline during the lifetime of an SHM system.

INTRODUCTION

Structural Health Monitoring (SHM) systems have the role to continuously monitor the health of a structure with the help of an array of sensors and actuators surface-mounted or embedded in a hosting structure. Piezoelectric ceramic discs (PZTs) are among the most widely used for SHM applications because they can

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Ключевые слова:

Содержание.