

MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
Smart Materials and Adaptive Structures (5)

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THE HEALTH MONITORING OF THE COMPOSITE MATERIALS ON SPACECRAFT BASED ON  
FIBER GRATING SENSORS

**Abstract**

Fiber optic sensors are small, lightweight, easy multiplexing, and immunity to electromagnetic. Due to these advantages, they are used to monitor the stain and temperature on the spacecraft. As the health monitoring technologies of the fiber sensor are applied, both the number of sensor cables and the volume of the demodulator are reduced. Because many important structures on the spacecraft use the composite material to reduce the weight of the whole machine, detecting the stain and temperature of the composite material become important. For the composite material could ensure more deformation than the traditional materials such as metal, the strain sensors with the wide range are needed.

Common fiber grating strain sensors are used in the range from  $-2500 \mu\varepsilon$  to  $2500 \mu\varepsilon$ . But the deformation of the composite material can be used more than  $12000 \mu\varepsilon$ . To detect the real deformation of the structure of composite material, get the strain and temperature field of the flight process in real time, we design a class of large scale fiber grating strain sensors. These sensors can be used to detect the strain of the surface, the deformation of the cavity, the expansion of the shell etc. Depend on the varied package method, several kinds of the fiber strain sensor with the range larger than  $20000 \mu\varepsilon$  are presented. What's more, the skill of the installation is researched too. Based on these studies, the fiber grating strain sensors with wide range could work in the environment of high temperature and violent vibration.