

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Environmental Effects and Spacecraft Protection (6)

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TEMPERATURE MONITORING OF THERMAL-VACUUM TESTS WITH OPTICAL FIBER
SENSORS.

Abstract

LARES-lab is a facility of Sapienza University of Rome for testing nano-satellites and small payloads in simulated space environment. The facility is equipped with a small cubic thermal-vacuum chamber with an internal volume 60x60x60 cm, capable of reaching very high vacuum conditions. The chamber simulates radiation thermal exchanges toward deep space with nitrogen cooled shrouds and solar radiation with a Sun simulator lamp. Several tests of payloads and nanosatellites have been already performed in LARES-lab, including the qualification tests of the LARES (LAsER RELativity Satellite) laser retro-reflectors, CHAMP and GRACE laser retro-reflectors, components of Tigrisat (the first Iraqi satellite) and EduSat. The temperatures of the shroud walls and of the specimens under test are recorded using Resistance Temperature Detector PT100 sensors. Electrical feed-throughs allow monitoring up to 12 PT100 sensors. The number of sensors is limited by the available channels on the monitoring systems and by the number of electrical connections on the feed-throughs. Recently the chamber has been upgraded with the installation of an optical feed through to use Fiber Bragg Grating (FBG) optical fiber sensors for temperature monitoring during the tests. One advantage of the FBG sensors is the multiplexing capability: one single optical fiber can carry an array of several sensors, reducing the number of wires required. The multiplexed sensors can be monitored by a single channel monitoring system. In this way the number of sensors which can be installed and monitoring is dramatically increased over the limits imposed by resistive sensors, and the electrical feed-throughs are left free for the connection of other sensors and to power resistive heaters or circuits. Moreover, it is possible to test a promising technology which will be increasingly used in space mission in the near future because of its intrinsic advantages. In this paper, some results of the first tests with FBG sensors in simulated space environment will be presented.