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Microgravity Sciences Onboard the International Space Station and Beyond - Part 1 (6)

Author: Prof. Loredana Santo
University of Rome - Tor Vergata, Italy, loredana.santo@uniroma2.it

Prof. Fabrizio Quadrini
University of Rome "Tor Vergata", Italy, fabrizio.quadrini@uniroma2.it
Dr. Gabriele Mascetti
Italian Space Agency (ASI), Italy, gabriele.mascetti@asi.it
Dr. Ferdinando Dolce
Italy, ferdinando.dolce@aeronautica.difesa.it
Dr. Valfredo Zolesi
Kayser Italia Srl, Italy, v.zolesi@kayser.it

MISSION STS-134: RESULTS OF SHAPE MEMORY FOAM EXPERIMENT

Abstract

Shape memory epoxy foams were used for an experiment aboard the International Space Station (ISS) to evaluate the feasibility of their use for building light actuators and expandable/deployable structures. The experiment was performed by an autonomous device contained in the BIOKON (by Kayser Italia) container which was in turn composed of control and heating system, battery pack and data acquisition system. To simulate the actuation of simple devices in micro-gravity conditions, three different configurations (compression, bending and torsion) were chosen during the memory step of the foams so as to produce their recovery on ISS. Micro-gravity does not affect the ability of the foams to recover their shape but it poses limits for the heating system design because of the difference in heat transfer on earth and in orbit. A 70 % recovery was measured at a temperature of 110 C. A full recovery of the foam samples was not achieved due to some limitations of the equipment for safety reasons. On ground laboratory experiments showed that 100% recovery could be reached just by increasing the maximum temperature to 120 C. Experiment results have provided many useful information for designing of a new structural composite actuator by using shape memory foams.