MICROGRAVITY SCIENCES AND PROCESSES (A2)
Microgravity Experiments from Sub-orbital to Orbital Platforms (3)

Author: Dr. Alessandro La Neve
Centro Universitário da FEI, Brazil

Dr. Marcello Bellodi
Brazil
Dr. Mauricio Ferreira
Brazil
Dr. Marco Antonio Assis Melo
Brazil
Dr. Fernando dos Santos Ortega
Brazil
Mr. Acacio Nunes Pereira
Brazil

CARBON NANOTUBES EXPERIMENT IN MICROGRAVITY

Abstract

Carbon Nanotubes (CNTs) nanostructures are an interesting focus of research, due to their unique electrical and mechanical properties, such as high specific surface area and electrical conductivity, making them potential components for applications in microelectronics and others. The experiment purpose is to obtain CNT homogeneous films on aluminum substrates in microgravity, and measurements will be performed to study the real effect of this environment in the deposits organization: this may determine what is really due to gravitational force and what may be caused by other variables. This experiment was realized in microgravity, during a period of 4 minutes, aboard a VSB-30 Brazilian sounding rocket, in December 12th, 2010. To perform the experiment, it was developed an equipment, called CADEN, which consists of 3 sets of 4 aluminum reaction chambers each (in a total of 12), containing embedded electronics, responsible for the system control, data acquisition and monitoring of electric currents in each chamber. The chambers were loaded with a CNT solution in different concentrations, 0.1 mg/ml and 0.5 mg/ml; in each of them an electrolytic current flew according to the electrical potential applied to the aluminum plates, which acted as anode and cathode. In order to provide for a wide range of possibilities, which might be useful in further analysis, different DC voltages were applied to each pair of chambers, which were loaded with different CNT concentrations. On receiving the microgravity signal, on flight, the control system applies a different bias on each of the three sets. From this moment on, each pair of chambers will be active for 2 or 4 minutes time, accordingly to their programming. While the experiment is running, the electric currents that flow through all chambers, along with temperature and other variables, are periodically read and stored in the internal memory, and are also transmitted by telemetry. The launching and payload rescue were successful, and so was the equipment functioning. The aluminum plates are now going through several analyses. Electrodes electrical characterization is being performed, focusing on the plates surface resistivity, and it shows a significant increase in electrical conductivity. Additional analyses include plate surfaces electron microscopy, to verify both CNT deposition morphology and the nanotubes orientation on the surface. The results will be compared with data obtained on earth under similar conditions, to identify the influence of microgravity and the role of the other variables in the experiment.