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

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A COMPARISON OF THE REFLECTIVITY OF TI6AL4V SAMPLES SHIELDED WITH NANOTUBE ARRAY BEFORE AND AFTER BEING MELTED IN MILIGRAVITY CONDITIONS

Abstract

The following research is part of the REXUS/BEXUS programme, which is realised under a bilateral Agency Agreement between the German Aerospace Center (DLR) and the Swedish National Space Board (SNSB). EuroLaunch is a cooperation between the Esrange Space Center of SSC and the Mobile Rocket Base (MORABA) of DLR and it is responsible for the campaign management and operations of the launch vehicles. An experiment containing a 25W LASER diode and Ti6Al4V samples will fly in May 2014, on board of a sounding rocket where miligravity conditions are simulated. One of our main scientific objectives is to determine the changes in reflectance of Titanium after being melted in miligravity conditions, and compare with the results gathered in Earth-based laboratory. During flight, the samples are exposed to infrared light generated by our 25W LASER diode, and reflectivity measurements will be performed after the experiment is recovered. Due to the fact that different topologies of titanium nanotubes lead to distinct light absorption, an in-depth analysis was performed in the laboratory, in order to increase the efficiency of the melting (enhance the photoabsorption). A FDTD (Finite Difference Time Domain) analysis was developed to simulate the light propagation at 975 nm through titanium nanotube array. The validity of the numerical simulations will be certified after this alloy is melted under miligravity conditions.

A Scanning Electron Microscope (SEM) and a Transmission electron microscope(TEM) were used to determine the nanotubular array on the samples. For the optical properties measurement, especially an absorption in specific wavelengths, a Fourier Transform Infrared Spectroscopy (FTIR) technique was used. Results in this field were provided by a Michelson interferometer adapted for FTIR, which also gave information about Raman scattering connected to infrared illumination. In conclusion, nanotubes grown on Titanium samples or, specifically on Ti6Al4V alloys, have showed a remarkable application because of their good charge-transport properties, thus making our research a significant breakthrough.