

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Virtual Presentations - IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (VP)

Author: Mr. Ali Alhammadi
Khalifa University of Science and Technology (KUST), United Arab Emirates

Ms. Maryam Alansaari
United Arab Emirates Space Agency, United Kingdom

THE MEONS EXPERIMENT: EVALUATING THE EFFECT OF MICROGRAVITY ON CORONARY
NITINOL STENTS

Abstract

The "Microgravity Effect on Nitinol Stents (MEONS)" experiment aims to study the mechanical performance of Nickel-Titanium stents under the changing human body behavior under microgravity. Coronary stents are tube-shaped devices that are placed inside coronary arteries, which are responsible of supplying blood to the heart, in order to keep the arteries unblocked during the treatment of cardiovascular disease. Medical stents are manufactured using various materials. One material that is currently being used to create stents is Nitinol, which is a nickel-titanium alloy distinguished from other materials by its shape memory and super-elastic characteristics. As seen in previous International Space Station experiments, microgravity significantly changes the behavior of the human body, and this includes the unusual function of the cardiovascular system. Moreover, if a critical condition occurs to a person under microgravity, a stent-based medical procedure could be performed in order to stabilize the condition. Stents experience stress cycles when placed inside an artery and this may lead to failure due to fatigue. In this experiment, the effect of microgravity on the behavior of a Nitinol stent shall be evaluated. In order to conduct the experiment, a design has been developed which includes several components, namely, a Nitinol stent, a flexible thin tube, a miniature pump that pumps artificial blood, a micro-controller, and a strain gauge that records strain data. Different stress conditions would be simulated using the pumping system. Moreover, the chosen artificial blood sample has a viscosity and a density similar to that of real blood. The strain gauge shall collect radial strain when placed on the outer surface of the tube. The gathered data will be used in order to predict the fatigue life of the stent, as well as to provide a baseline for the Finite Element Analysis results. A NanoLab will host the experiment platform, which is going to be sent to the International Space Station, where the experiment shall be conducted. The outcomes of the MEONS experiment will aid scientists in developing space-grade stents that could be of use in the future.