MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Facilities and Operations of Microgravity Experiments (5)

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GENERATION OF ARTIFICIAL GRAVITY BY ULTRASOUNDS TO OVERCOME MICROGRAVITY ENVIRONMENTS

Abstract

Levitation of small objects in air and liquids exposed on Ground to acoustic standing waves has been extensively reported in the literature for environmental, biomedical and other applications. This effect is due to a radiation force induced by acoustic waves established in a vertical direction, parallel to the gravity with opposed direction. This force drives the objects toward a position of acoustic equilibrium, where remain collected during the acoustic actuation. Such a location can be a pressure node or antinode, depending on the acoustic contrast factor of the object to be levitated with respect to the fluid where is immersed (air or liquid). Based on the same principle of the acoustic levitation, artificial gravity can be induced in microgravity environments. It can be of high interest for diverse purposes, involving inorganic and organic material. It can be applied for manipulation of grain matter, control of fluids or to stimulate certain processes in organic material, of difficult progression in outer space (associated to the absence of gravity. The frequency, amplitude and other acoustic parameters are key elements for each application selected, which require specific strategies for the transducer designs. Here we describe the principles of operation of our acoustic technology and present some of our ultrasonic resonators developed to work at different frequencies creating levitation for different applications. They include high, medium and low power ultrasound actuations, depending on the specific application of interest developed on Ground. We consider some of these developments of interest in microgravity environments, which could be applied for possible future missions. It could be of particular relevance in human flights /ISS stays to overcome some problems aboard and exploratory missions on Mars.