

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Science Results from Ground Based Research (4)

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SOLUTO-VIBRATIONAL CONVECTION UNDER LOW GRAVITY: PREPARATION OF
PARABOLIC FLIGHT

Abstract

Effect of high frequency vibration on two miscible liquids entering into contact via horizontal interface inside a container leads to intensive mixing and solution's homogenizing. These phenomena will be investigated during 50th campaign of ESA Parabolic Flights. Theoretical part of preparation is devoted to direct numerical simulations of mathematical model that is described by averaged Navier-Stokes equations. The aim of this study is to analyze the physical mechanism by which vibrations affect the mixing characteristic of two stratified miscible fluids. The translational periodic vibrations are imposed to a rigid cell filled with two different mixtures of water-isopropanol. The vibrations with a constant frequency and amplitude are directed along the interface. Preliminary results of preparation highlight the strong interplay between gravity and vibrational impact, the relative weight of each effect is determined by ratio vibrational and classical Rayleigh numbers. In this system the added vibration of vessel generates an inertial force which acts like a gravity and leads to different phenomena such as instability, interface displacement and deformation etc. The relative importance of each effect is determined by vibration impact (frequency and amplitude), properties of mixture components (viscosity and diffusion) and initial distribution of composition. The influence of these parameters on the onset, development of mass transfer and mixing characteristics is the main subject of the present study. In experimental stage of preparation the design of setup in flight configuration has been developed. The digital optical method was used for recording and treatment of the concentration field. Several ground-based experiments on vibrational convection have been performed for testing and adjusting of the system.