



EFFECT OF LIQUID-BRIDGE SHAPE ON THE INSTABILITY OF MARANGONI CONVECTION IN SPACE EXPERIMENT

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KEYWORDS:

Main subjects: flow visualization, space experiment, flow instability

Fluid: Marangoni convection, silicone oil, liquid bridge

Visualization method(s): tracer method, 3-D particle tracking velocimetry, IR camera

Other keywords: oscillation, volume ratio, liquid-bridge shape

ABSTRACT: The effect of liquid-bridge shape on the instability of Marangoni convection has been studied through flow visualization conducted in space experiment. Liquid bridges of silicone oil (20cSt) with various volume ratios are generated in microgravity. They are suspended between coaxial disks 30mm in diameter and 30mm in their axial separation. No gravity-induced deformation of liquid bridge is seen as shown in Fig. 1. The volume ratio, V_r , denotes the ratio of the liquid volume to the volume of the gap between the disks. Marangoni convection is generated by the temperature difference imposed to the disks. The onset of oscillation from a steady laminar flow to an oscillatory 3-D flow is determined through flow visualization based on the tracer method. Fig. 2 shows the effect of V_r on the critical Marangoni number for the onset of oscillation. These are the first experimental data taken from non-deformed liquid bridges. The present data differ from the data taken in terrestrial condition, indicating a significant effect of the liquid-bridge shape on the instability. Detailed characteristics of flow and temperature fields in oscillatory state are visualized by using 3-D particle tracking velocimetry and an IR camera.

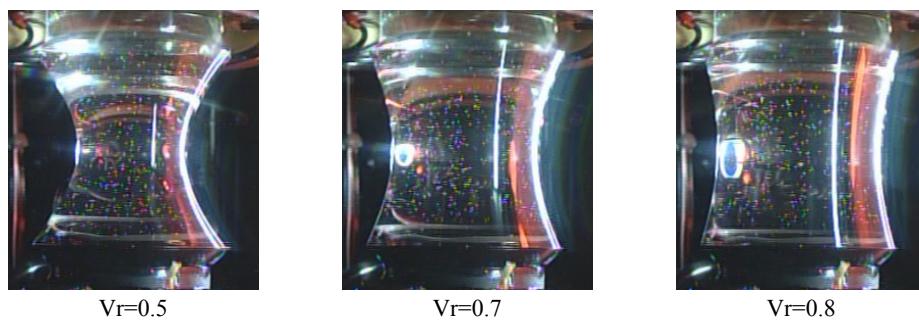


Fig. 1 Liquid bridges of silicone oil (20cSt) suspended between coaxial disks 30mm in diameter

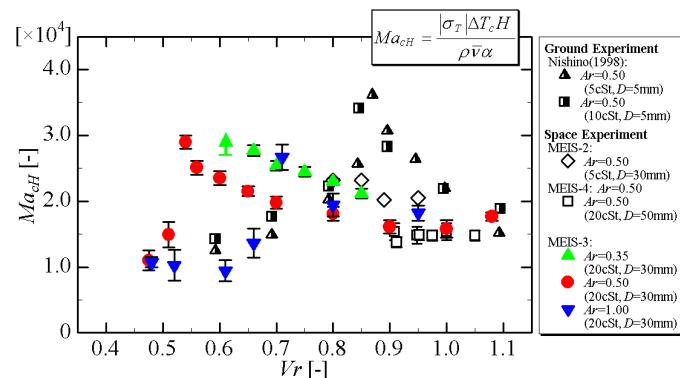


Fig. 2 Effect of the volume ratio on the critical Marangoni number for the onset of instability