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Fluid and Materials Sciences (2)Author: Prof. Shinichi Yoda
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Prof. Ichiro Ueno
Tokyo University of Science, JapanTHE CRITICAL MARANGONI NUMBER DEPENDENCE WITH LIQUID BRIDGE DIAMETER IN
HIGH PRANDTL FLUIDS**Abstract**

Many experiments to determine the critical Marangoni number at the onset of oscillatory flows for high Prandtl number (Pr) fluids have showed dependence of the diameter of the liquid column, although the aspect ratio of the column is the same. This fact contradicts the similarity principle in fluid physics. The Marangoni experiments have been being done to make clear what is Marangoni transition behavior by using Silicone oil with 50mm diam. The results were compared with previous experiment results with 30 mm diam. (JAXA experiments of MEIS1 and 2) and 5mm diam. obtained on ground. The dependency of critical Marangoni number can be expressed by the order of almost $2/3$ power of the critical number, which is good agreement with our modeling by considering thermal boundary layer formed around the both heating and cooling desks. Different aspect ratio(Liquid length/Diam.) of 0.1 to 1.25 of liquid bridges were also studied by defining critical Marangoni number. The experiments has carried out Critical Marangoni number from laminar to Oscillatory flow by decreasing temperature as steps with 0.5 to 1 K holding time of almost 60 min this method of which is to get stable condition. The Prandtl number used in this experiments is 68, which is the as previous JAXA experiments, MEIS1 and 2. The results that can be concluded at present are as follows: 1) The critical Marangoni number vs aspect ration curves shows as follows; Firstly, critical Marangoni numbers decreases with increasing aspect ratio until 0.4 aspect ratio, and after that increases with increasing aspect ration having maximum value at around 1.25 aspect ratio. The tendency of the results are analyzed by numerical simulation, the results of which are good agreement with each other.