

Experimental Investigations on the Mechanism of Stratified Liquid Mixing in a Cylinder

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Abstract : In this paper, the mechanism of stratified liquids' mixing in a cylinder is investigated. It is focused on the effects of Rayleigh-Taylor Instability (RTI) and rotation of the cylinder on liquid interface mixing. For miscible liquids, Planar Laser Induced Fluorescence (PLIF) technique is applied to record the concentration field for one liquid. Intensity of Segregation (IOS) is used to describe the mixing status. For immiscible liquids, High Speed Camera is adopted to record the development of the interface. The experiment of RTI indicates that it plays a great role in the mixing process, and meanwhile the large-scale mixing is triggered, and subsequently the span of the stripes decreases, showing that the mesoscale mixing is coming into being. The rotation experiments show that the spin-down process has a great role in liquid mixing, during which the upper liquid falls down rapidly along the wall and crashes into the lower liquid. During this process, a lot of interface instabilities are excited. Liquids mix rapidly in the spin-down process. It can be concluded that no matter what ways have been adopted to speed up liquid mixing, the fundamental reason is the interface instabilities which increase the area of the interface between liquids and increase the relative velocity of the two liquids.

Keywords : interface instability, liquid mixing, Rayleigh-Taylor Instability, spin-down process, spin-up process

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