化工学报 2005 56 (12): 2288-2293 ISSN: 0438-1157 CN: 11-1946/TQ

多相流

面激光诱导荧光技术用于快速液液微观混合研究

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收稿日期 修回日期 网络版发布日期 接受日期

摘要 建立了面激光诱导荧光技术研究液液微观混合过程的实验方法，在无干扰流场条件下，研究了毫米尺度流道内、错流接触的两股液膜的时空混合行为，以可视化的手段揭示了液液微观混合过程的二维瞬态浓度场，发现了液膜快速错流接触后形成的有序波形涡结构，涡的尺度大小为1～2 mm，涡的发展过程是影响两股流体混合的主要因素. 同时建立了混合过程的定量表征方法，用混合液膜中组分的离析度（intensity of segregation, IOS）定量描述了混合过程所达到的程度，获得了不同液膜流速下液液混合过程IOS值随着液体流动方向的变化趋势图，并分析了两股液膜之间的速率比以及混合液膜的Reynolds数对混合过程的影响.

关键词 微观混合 面激光诱导荧光技术 无干扰流场测试技术 波形涡 离析度

分类号

Study of fast liquid-liquid micromixing using PLIF technique

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Abstract

Planar laser induced fluorescence (PLIF) technique was established to study the liquid-liquid turbulent micromixing process. A typical process of liquid-liquid cross-flow mixing in flow channels at millimeter scale was visualized by using this non-invasive measurement technique.Transient measurements of concentration field highlighted by the excited fluorescence dye were recorded. A wave-like vortex structure at the scale of 1 to 2 millimeter was found after the two liquid cross flows met each other. The results showed that the development of the vortex was the main factor affecting the mixing performance.The mixing process was also analyzed quantitatively by using the intensity of segregation (IOS).The trend of IOS value vs y locations was also illustrated and the effect of velocity ratio of two liquid flows and Reynolds number of the mixing liquid flow on the mixing process was studied.

Key words micromixing planar laser induced fluorescence (PLIF) non-invasive measurement wave-like vortex intensity of segregation

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