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Chaotic Mixing in a Meandering Channel Segmented by Gas Bubbles METIN MURADOGLU, Koc University, HOWARD A. STONE, Harvard University — Mixing in a meandering channel segmented by gas bubbles is studied computationally in a two dimensional setting using a finite-volume/front-tracking method. Molecular diffusion is neglected and only the stirring due to chaotic advection is considered. Passive tracer particles are used to visualize the mixing patterns and mixing is quantified using both an entropy measure and average stretching of fluid elements. It is found that the corrugation of the channel, the capillary number and the distance between the bubbles relative to the channel width are the most important parameters influencing the quality of mixing. The liquid film between the bubbles and the channel wall causes a leakage that significantly deteriorates the quality of mixing in the bulk fluid. It is verified that the film thickness δ normalized by the channel width h increases with the capillary number as $\delta/h \sim Ca^{2/3}$ in straight portions of the channel but it increases rapidly as the bubble turns around a sharp corner. Therefore the leakage is much larger in a winding channel than that in a straight channel. It is also found that the bubble size does not have a significant influence on the mixing if it is equal or larger than the channel width but the mixing quality decreases rapidly as the bubble size gets smaller than the channel width due to increased leakage. The mixing is found to be weakly dependent on the Reynolds number and the viscosity ratio.

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