Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Axial Dispersion in Segmented Gas-Liquid Flow in Curved Channels[1] METIN MURADOGLU, Koc University, AXEL GUENTHER, M.I.T., HOWARD STONE, Harvard University — Segmented gas-liquid flows have been studied for many years because of their applications in chemical analyses, and recently have been studied widely owing to developments in microfluidics. Here axial dispersion of a tracer in liquid flow segmented by gas bubbles is studied computationally in a two-dimensional setting using a finite-volume/front-tracking method. Both straight and curved channels are considered. We find that the dispersion increases as the Peclet number (Pe) decreases both in straight and curved channels but there is a significant difference between the straight and curved channel cases at high Peclet numbers. When the Peclet number is sufficiently large so that molecular diffusion is negligible, there is essentially no dispersion in the straight channel case since a lubricating thin liquid layer persists on the wall as observed by Kreutzer et al. (2005). However the lubricating liquid layer is periodically broken in the curved channel case leading to enhanced axial dispersion. Good agreement is found between the computational results and the lumped parameter model of Pedersen and Horvath (1981) when Peclet number is sufficiently low, i.e., the film and bulk regions are mixed well.

[1]The first author is supported by the Scientific and Technical Research Council of Turkey (TUBITAK) (105M043).

Metin Muradoglu
Koc University

Date submitted: 02 Aug 2006 Electronic form version 1.4