Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Mass transfer through laminar boundary layer in 2-d microchannels with nonuniform cross section: the effect of wall curvature AUGUSTA PEDACCHIA, ALESSANDRA ADROVER, La Sapienza Università di Roma — We provide an analytical solution for the combined diffusive and convective 2-d mass transport from a surface film (of arbitrary shape at a given uniform concentration) to a pure solvent flowing in creeping flow conditions into a microchannel, delimited by a flat no-slip surface and by the releasing film itself. Such a problem arises in the study of swelling and dissolution of polimeric thin films under the action of a solvent tangential flow simulating the oral thin film dissolution for drug relase towards the buccal mucosa or oral cavity. We present a similarity solution for laminar forced convection mass (or heat) transfer that generalizes the classical boundary layer solution of the Graetz-Nusselt problem (valid for straight channels or pipes) to a solvent flowing in creeping flow conditions into a 2-d channel with cross-section continuously varying along the axial coordinate x. Close to the releasing boundary, parametrized by a curvilinear abscissa s, both tangential and normal velocity components play a role and their scaling behavior, as a function of wall distance r, should be taken into account in order to have an accurate description of the concentration profile in the boundary layer and of the dependence of the Sherwood number on the curvilinear abscissa s.

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Date submitted: 30 Jul 2012 Electronic form version 1.4