459e Transient Bio-Molecular Transport in Nanofluidic Devices

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Unsteady simulation of species transport in Electroosmotic Flow (EOF) has been carried out for a three component system in a nanoconstrained channel. The effect of the concentration on the transport of the tracked species is assessed and the relative influence of the concentration of the underlying buffer is also considered. The flux of any species is caused by Fick's diffusion, electrophoretic drift and advection due to bulk flow. It is found that for any species, the three driving forces can act in the same direction or in opposite directions. The mutual balance between these driving forces determines the direction of the movement of the species as well as its transit time. For a charged species, the electrophoretic drift term is extremely important. For EOF in a channel with negatively charged walls, a negatively charged species may move in a direction opposite to the direction of bulk fluid flow. A positive species is transported in the direction of fluid flow and there is a significant decrease in transit time. Transport of a a negatively charged species in channels with postively charged walls will behave similar to the transport of a positively charged species with negatively charged walls. Applications to rapid molecular analysis, drug delivery, biochemical sensing and species separation are also discussed.