Flow fraction in charged slit-like microfluidic channels for hydrodynamic particle focusing

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The electrokinetic effect influences the fluid flow behavior in charged microchannel, in which the passage of reagents or biological samples is controlled. The external body force appeared from the electrostatic interaction between the nonlinear Poisson-Boltzmann (P-B) field and the flow-induced electrical field is applied to the Navier-Stokes equation of motion. The P-B electric potential profile is predicted by applying the finite difference method, and an analytical solution to the equation of motion for slit-like microchannel is derived via the Green's function. A precise estimation of the fractioned boundary width of the focused stream is necessary to design the optimal channel. We consider the flow fraction with variations of channel aspect ratios (i.e., ratio of height to width) and charge properties (e.g., surface potential and electric double layer). Our results provide useful information of fluid flows in microfluidic devices to accomplish highly efficient particle counting and sorting.