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Electrophoretic extraction of ions from a pressure-driven flow[1]
HAO LUO, BOYD EDWARDS, SCOTT MILLER, BRENT RESCHKE, AARON TIMPERMAN, WVU TEAM — Coupling pressure-driven and electrokinetically driven flow streams in microfluidics is a critical issue for developing multi-dimensional separations systems. A promising method of coupling these flows is to electrokinetically extract the charged components from the pressure driven flow stream while minimizing the hydrodynamic flow in the electrokinetically driven channel. To model this extraction process we calculate the fraction f of ions in a pressure-driven microchannel that are diverted electrophoretically to a perpendicular side channel. The channel cross sections are rectangular, with aspect ratio γ. In the main channel, we use truncations of an exact series solution to describe the laminar velocity profile of the aqueous solution. The aqueous solution in the side channel is stationary; individual ions move through this channel in response to a uniform applied electric field at an electrophoretic velocity that is proportional to this field. We calculate f as a function of γ and the ratio R between the flow rate in the main stream and that in the side stream. We find that f decreases with increasing R, as expected, and is nearly independent of γ.

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