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Finite Sample Effects in Temperature Gradient Focusing. HAO LIN, Rutgers University, JONATHAN SHACKMAN, DAVID ROSS, NIST — Temperature gradient focusing (TGF) is a new and promising microfluidic electrokinetic focusing method which can provide high concentration factors. In general TGF works in the linear regime where the analyte concentration is small when compared with buffer ion concentrations. However, this presumption may at times be violated. Under this situation strong nonlinear interactions between sample and buffer ions may occur, which eventually lead to peak shifting and distortion, and the loss of detectability and resolution. In this work we combine theory, simulation, and experiments to present a detailed study on nonlinear sample-buffer interactions in TGF. One of the key results is the derivation of a generalized Kohlrausch regulating function (KRF) that is valid for systems in which the electrophoretic mobilities are not constant but vary spatially. This generalized KRF greatly simplifies the analysis, reducing the problem to a single equation describing sample concentration evolution, and is applicable to other problems with heterogeneous electrophoretic mobilities. Using this sample evolution equation we have derived an understanding of the nonlinear peak deformation phenomenon observed experimentally in TGF. We have used numerical simulations to validate our theory, and to quantitatively predict TGF. Our results demonstrate excellent agreement with experiment.

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