**Electrokinetic analyte preconcentration in nanofluidic channels by field-effect modulation of surface charge density**

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It is well known that charged analytes in the presence of nonuniform electric fields concentrate at an interface where relevant driving forces balance. Nanofluidic channels with spatially varying conductivity distributions have been shown to provide increased stacking of charged analytes due to the existence of a finite electric double layer (EDL), in which electrostatic attraction and repulsion from charged surfaces produce nonuniform transverse ion distributions. In this work, we use numerical simulations to show that one can achieve greater levels of sample accumulation by using field-effect control via an embedded electrode to tailor the surface charge heterogeneity in a nanochannel with overlapped EDLs. The coupling between the two-dimensional thick EDL ion distributions and the axial electric field generates additional potential gradient to that observed with finite double layers which further concentrate sample ions at the interface between two regions of different surface charge density. Our numerical model uses the Poisson-Nernst-Planck system of equations to demonstrate the phenomenon, and we discuss in detail the driving forces behind the predicted sample enhancement. The numerical velocity and salt concentration profiles exhibit good agreement with analytical results, and show achievable amplification ratios of up to 105.