

Supporting Information

Salt Dependent Ion Current Rectification in Conical Nanopores: Impact of Salt Concentration and Cone Angle

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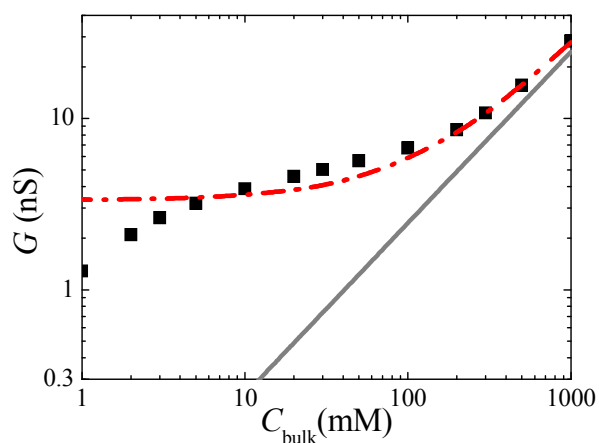


Figure S1. Variation of the conductance G with the bulk salt concentration C_{bulk} . Solid curve: bulk solution conductance; broken curve: analytic result at a constant surface charge density;¹ discrete symbols: present numerical result at $R_{\text{tip}}=6$ nm, $R_{\text{base}}=93.49$ nm, and $\sigma_s = -0.5$ e/nm².

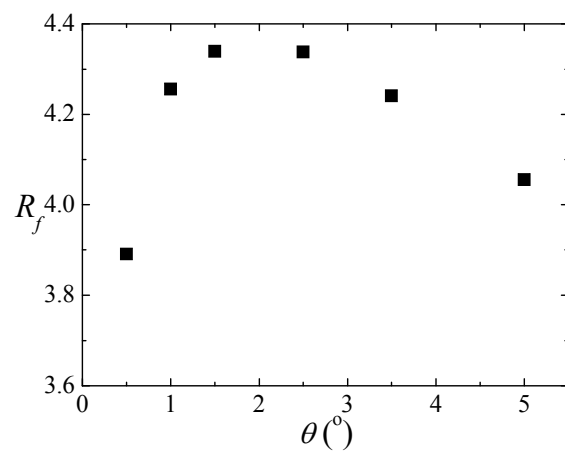


Figure S2. Current rectification ratio R_f as a function of the half cone angle θ for an aqueous KCl solution at $R_{\text{tip}} = 6 \text{ nm}$ and $C_{\text{bulk}} = 100 \text{ mM}$.

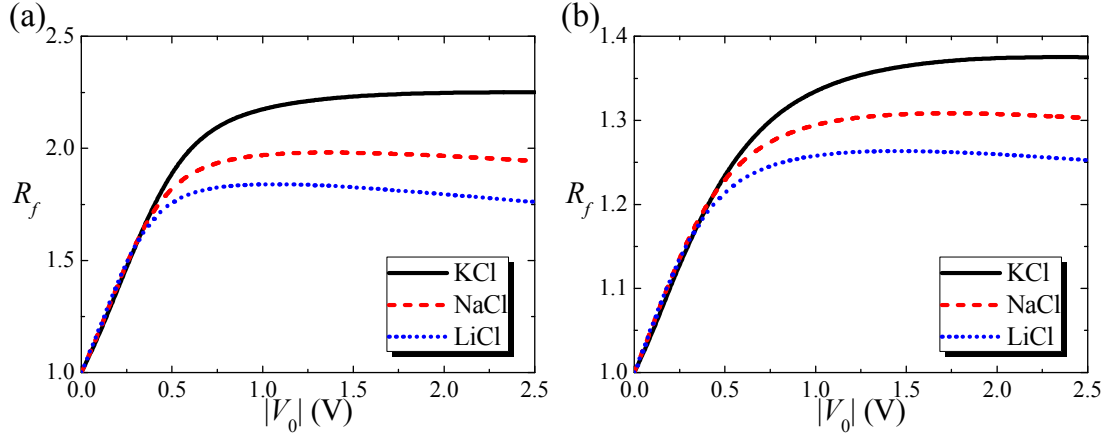


Figure S3. Current rectification ratio R_f as a function of the magnitude of the applied voltage, $|V_0|$, for various salt solutions at $R_{\text{tip}} = 6$ nm and $\theta = 1^\circ$. (a) $C_{\text{bulk}} = 300$ mM ; (b) $C_{\text{bulk}} = 1000$ mM .

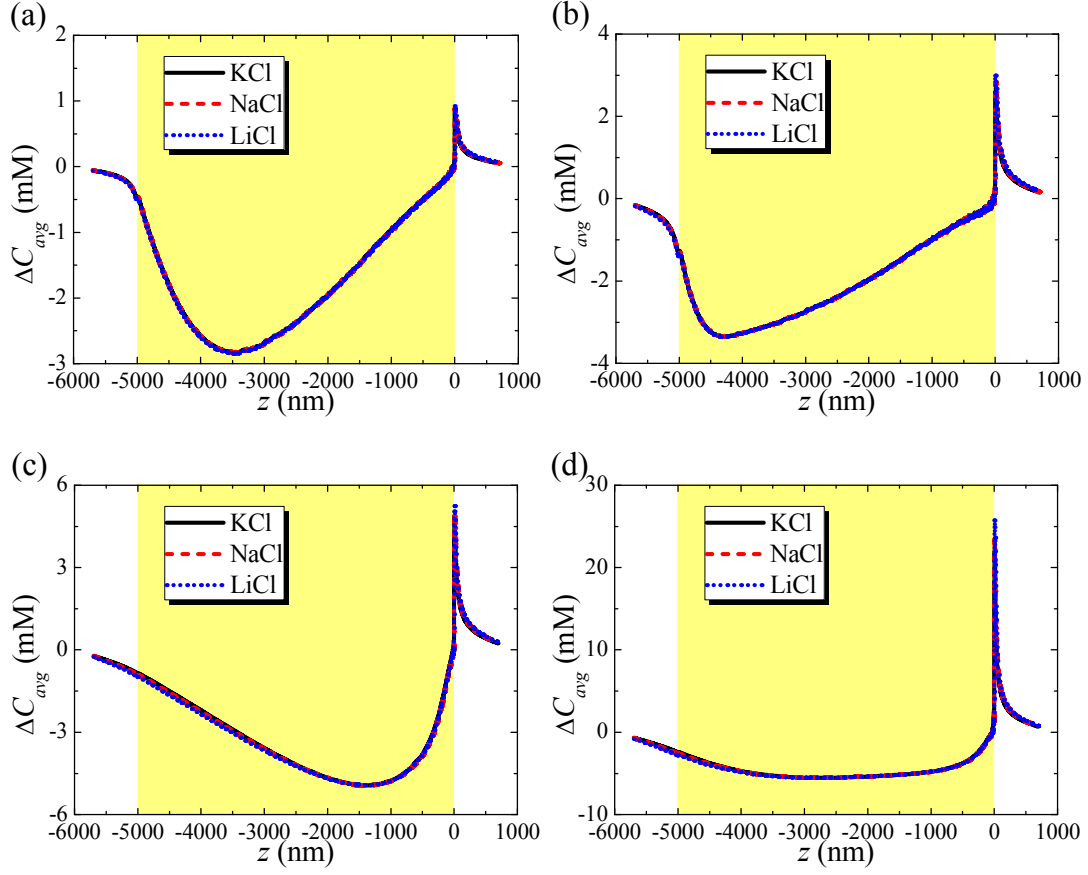


Figure S4. Axial variations in the cross sectional averaged concentration difference ΔC_{avg} under various conditions, where $R_{tip} = 6$ nm . (a) $C_{bulk} = 3$ mM , $\theta = 0.5^\circ$, and $V_0 = +0.5$ V (b) $C_{bulk} = 3$ mM , $\theta = 0.5^\circ$, and $V_0 = +1.5$ V , (c) $C_{bulk} = 3$ mM , $\theta = 5^\circ$, and $V_0 = +0.5$ V , (d) $C_{bulk} = 3$ mM , $\theta = 5^\circ$, and $V_0 = +1.5$ V .

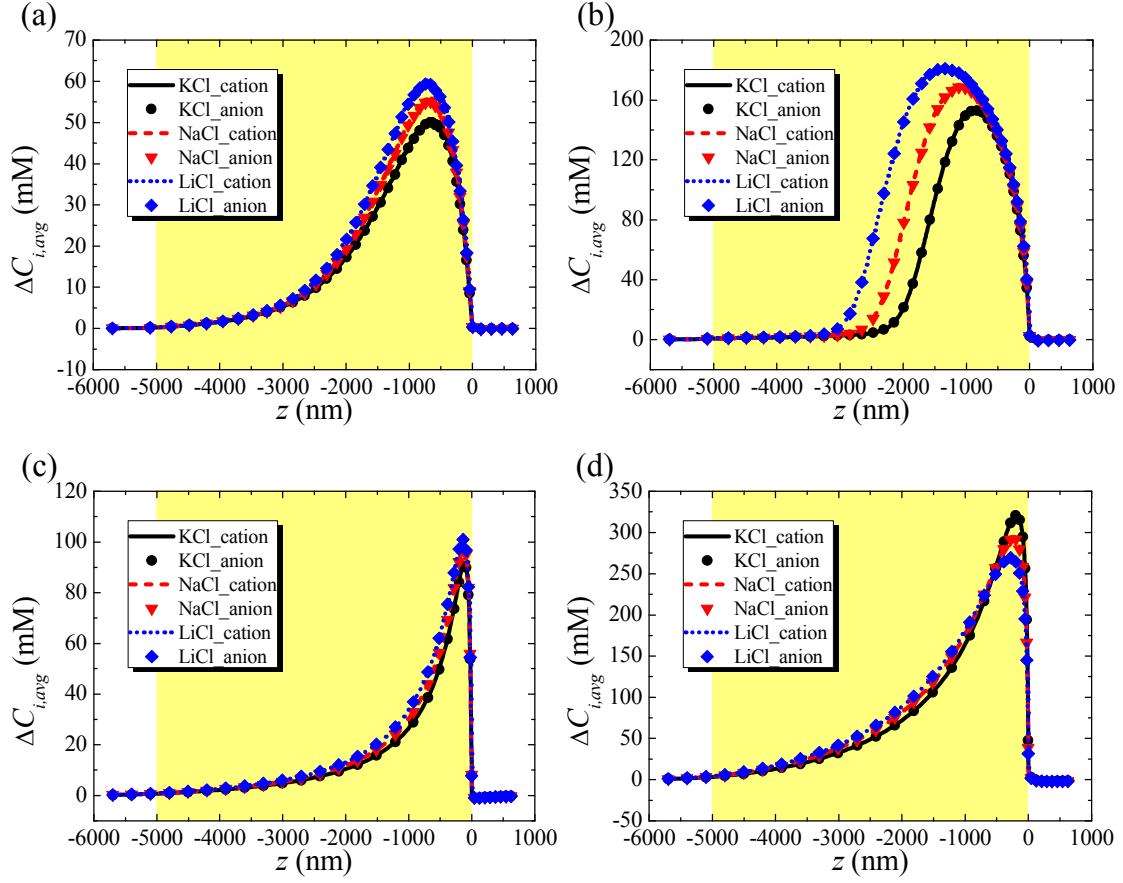


Figure S5. Axial variations in the cross sectional averaged concentration difference $\Delta C_{i,avg}$

under various conditions, where $R_{tip} = 6$ nm . (a) $C_{bulk} = 3$ mM , $\theta = 0.5^\circ$ and $V_0 = -0.5$ V

(b) $C_{bulk} = 3$ mM , $\theta = 0.5^\circ$, and $V_0 = -1.5$ V , (c) $C_{bulk} = 3$ mM , $\theta = 5^\circ$, and $V_0 = -0.5$ V ,

(d) $C_{bulk} = 3$ mM , $\theta = 5^\circ$, and $V_0 = -1.5$ V . Curves: cations; discrete symbols: anions.

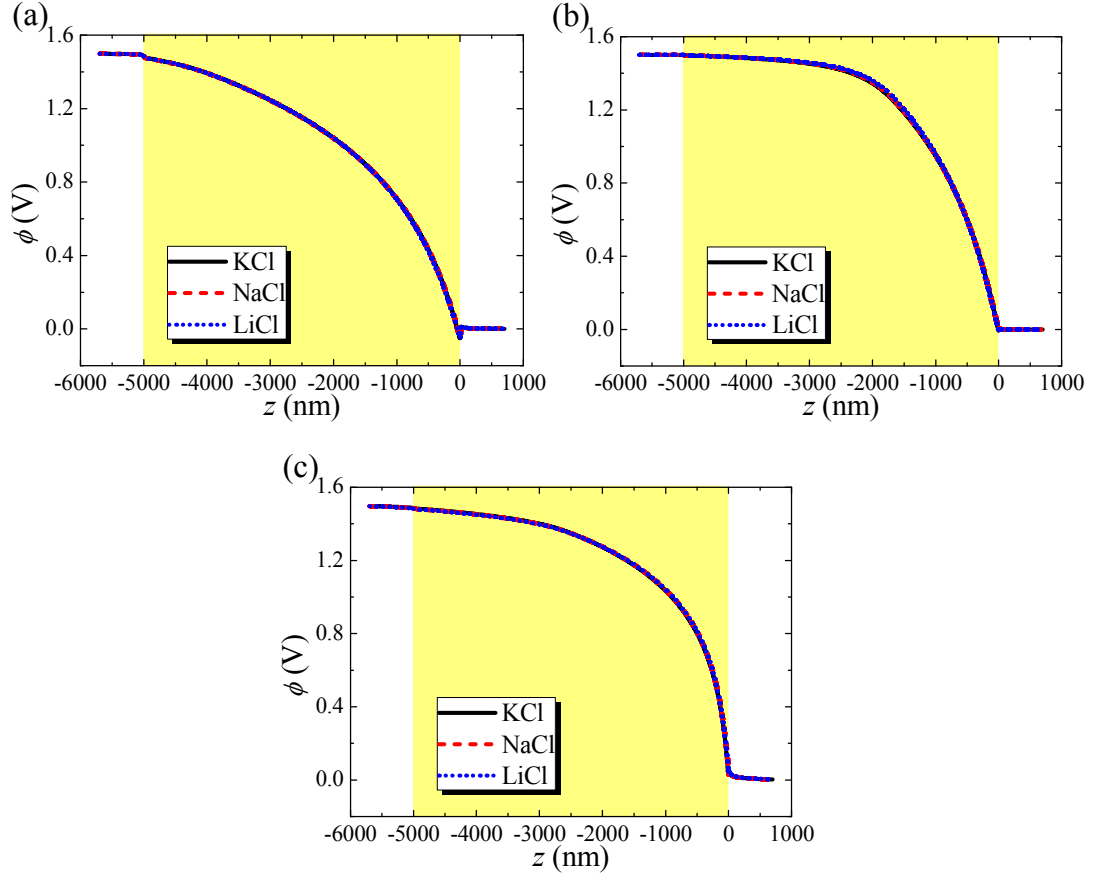


Figure S6. Axial variations of the electric potential ϕ at $V_0 = +1.5$ V under various conditions, where $R_{\text{tip}} = 6$ nm (a) $C_{\text{bulk}} = 3$ mM and $\theta = 1^\circ$; (b) $C_{\text{bulk}} = 100$ mM and $\theta = 1^\circ$; (c) $C_{\text{bulk}} = 3$ mM and $\theta = 5^\circ$.

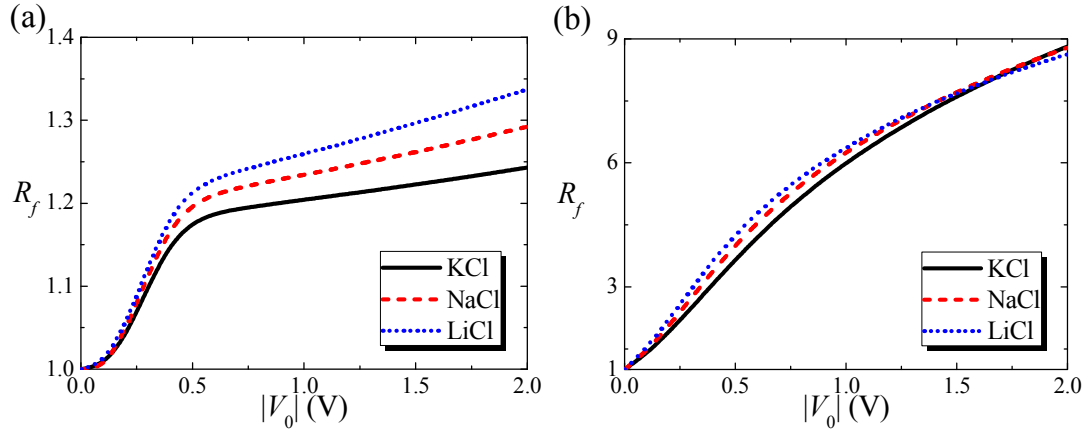


Figure S7. Current rectification ratio R_f as a function of the magnitude of the applied voltage, $|V_0|$, for various salt solutions at $R_{\text{tip}} = 3$ nm. (a) $C_{\text{bulk}} = 3$ mM and $\theta = 0.5^\circ$; (b) $C_{\text{bulk}} = 100$ mM and $\theta = 1^\circ$.

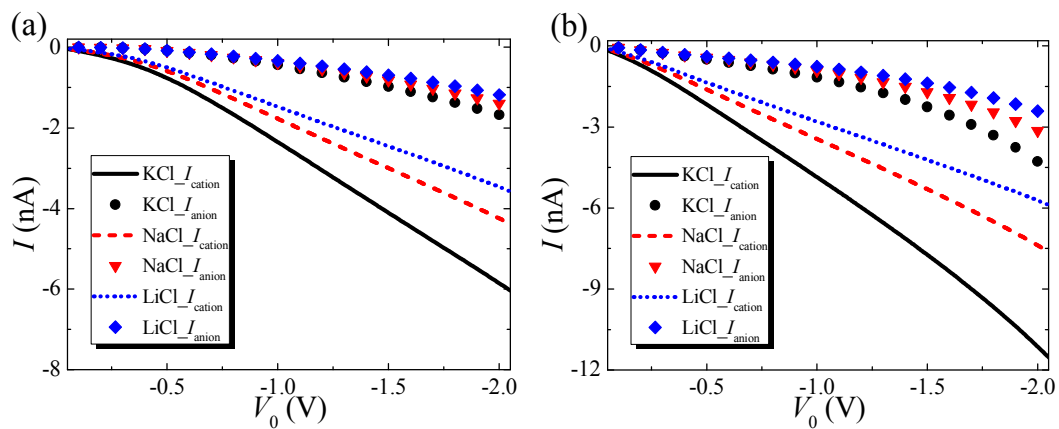


Figure S8. Ionic current-voltage curves for various electrolyte solutions at various combination of salt concentration C_{bulk} and half cone angle θ , where $R_{\text{tip}} = 6 \text{ nm}$. (a) $C_{\text{bulk}} = 3 \text{ mM}$ and $\theta = 5^\circ$; (b) $C_{\text{bulk}} = 100 \text{ mM}$ and $\theta = 5^\circ$.

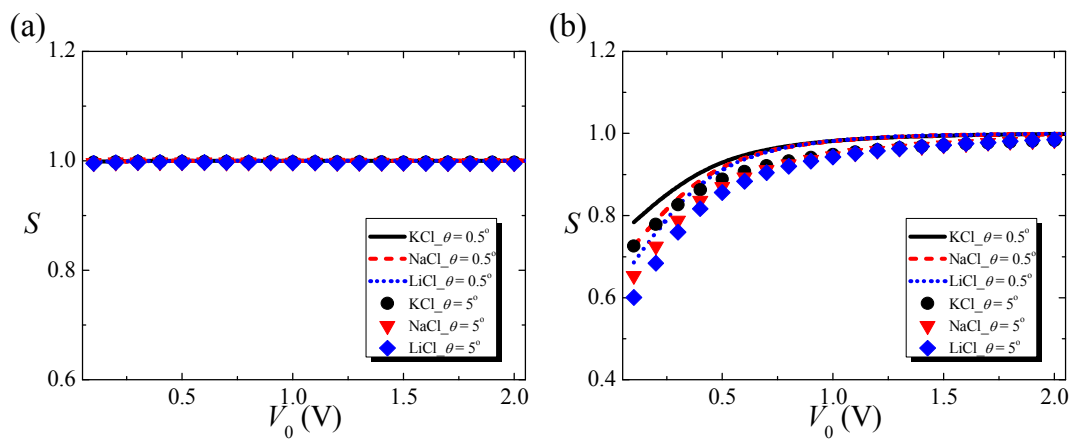


Figure S9. Variation of the selectivity S with the applied voltage bias V_0 when $R_{\text{tip}} = 6 \text{ nm}$ for various combinations of the type of salt and the half cone angle θ at $C_{\text{bulk}} = 3 \text{ mM}$, (a), and $C_{\text{bulk}} = 100 \text{ mM}$, (b).

REFERENCE

- (1) Steinbock, L. J.; Lucas, A.; Otto, O.; Keyser, U. F., Voltage-driven Transport of Ions and DNA through Nanocapillaries. *Electrophoresis* **2012**, *33*, 3480-3487.