Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supplementary Information: Soft ionic liquid based resistive memory characteristics in two terminal discrete polydimethylsiloxane cylindrical microchannel

Muhammad Umair Khan[a], Gul Hassan[a,b], and Jinho Bae[a*]

[a]Department of Ocean System Engineering, Jeju National University, 102 Jejudaehakro, Jeju 63243, Korea

[b]Centre for Advanced Electronics & Photovoltaic Engineering (CAEPE), International Islamic University, H-10, Islamabad 44000, Pakistan

[*]E-mail: baejh@jejunu.ac.kr

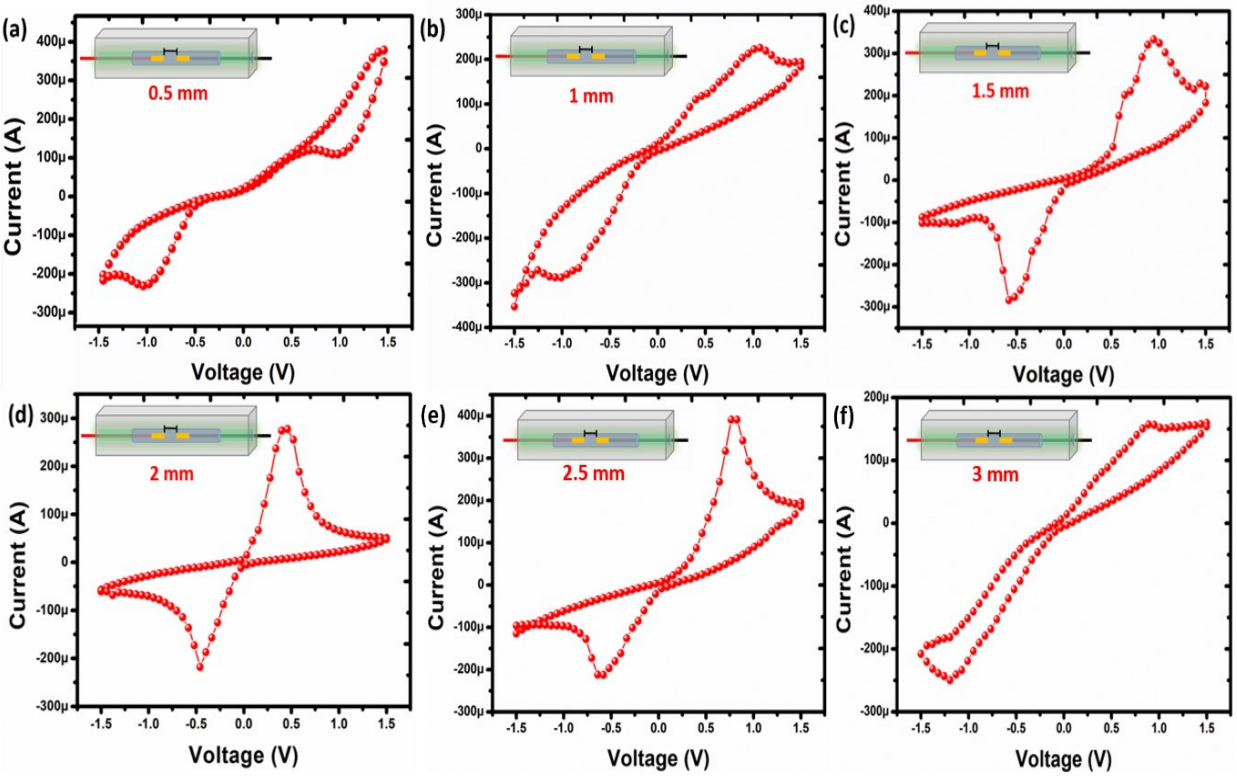

Fig. S1. The effecting electrode spacing on complimentary resistive switching (CRS) at (a) 0.5 mm, (b) 1.0 mm, (c) 1.5 mm, (d) 2 mm, (e) 2.5 mm, and (f) 3 mm.

Here, the distance between anode and cathode is measured with IJIN 06 DIGI microscope. The results are measured on different spacing from 0.5 mm to 3 mm and we found stable ionic liquid resistive memory function on 2 mm.

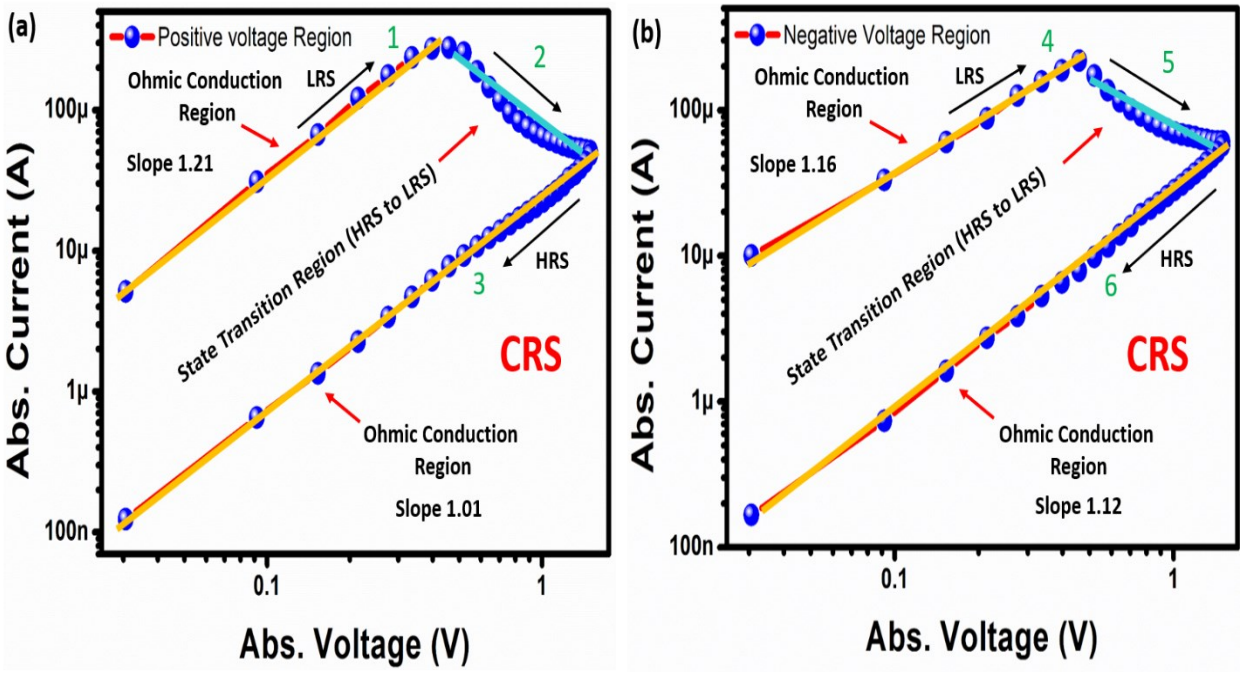

Fig. S2. Trap controlled space charge limited current (TCSCLC) mechanism in CRS showing, (a) positive voltage region and (b) negative voltage region.

The complementary resistive switching mechanism in the ionic liquid resistive memory device is well supported with double logarithmic current and voltage (I-V) graph as shown in Fig. S2a and b, which ensures that conduction model works on the principle of the trap controlled space charge limited current (TCSCLC) model, in which it shows two different values of slope; (i) ohmic conduction region ($I \propto V$) in HRS and LRS which is orange marked in region 1, 3, 4, and 6 and (ii) state transition region blue marked region (LRS to HRS in positive voltage region 2 and negative voltage region 5) as shown in Fig. S2a and b. During positive voltage sweep from 0 V to 0.6 V in region 1 with slope value of ~ 1.01 shows ohmic conduction, due to ionic movement result in diffusion-flux as shown in Fig. S2a. After 0.6 V ionic flux saturates on both electrodes in region 2 and current start decreasing from 0.6 V to 1.5 V and device moves from LRS to HRS in state transition region as shown in Fig. S2a. During voltage sweep from 1.5 V to 0 V device remain in HRS state due to ion depletion result in decrease in ionic flux. The HRS shows the ohmic behavior ($I \propto V$) in region 3 with slope value of ~ 1.21 as shown in Fig. S2a. The CRS in the negative bias region from 0 V to -1.5 V and -1.5 V to 0 V containing region 4, 5, and 6 showing yield of odd symmetry as shown in Fig. S3b, which confirms the double loop hysteresis pinched at origin.