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High Performing Ionic Liquid Enriched Hybrid RSDs

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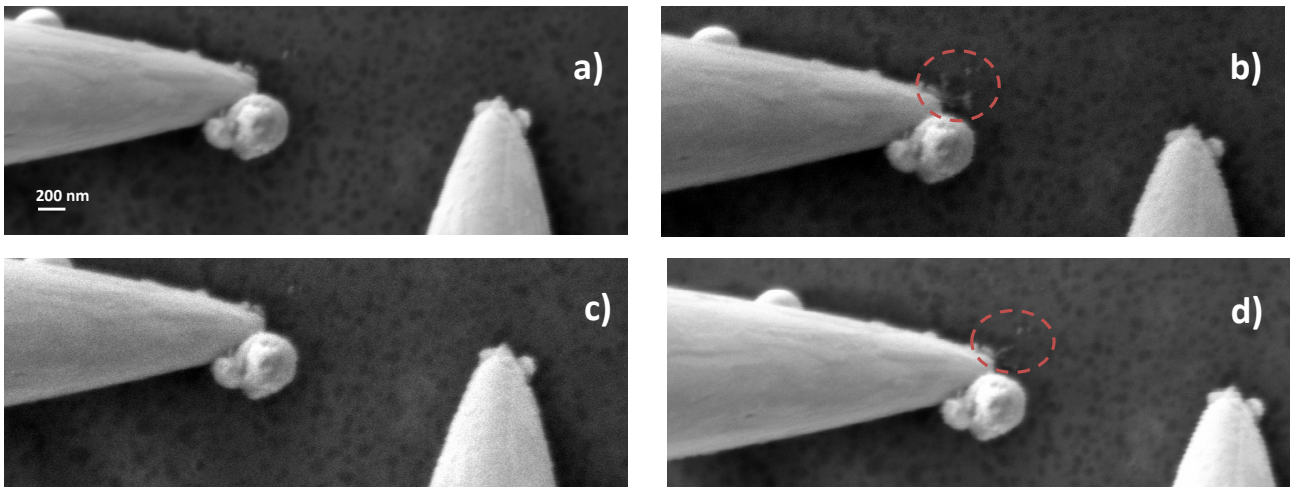

Figure S1: FESEM image showing the real time formation oand annihilation of silver filament. **a)** Initial state. the tungsten probes are placed in the switching matrix. **b)** Filamentary growth (circled in red) with the application of set field. **c)** Filament annihilation with the application of reset field. **d)** Filamentary observation (circled in red) with set field.

Figure **S1a** corresponds to the initial state where the tungsten probes are placed inside the switching matrix. The application of a continuous cyclic voltage to the switching matrix leads to the formation and annihilation of silver filament. Figure **S1b** clearly evidence the formation of a filament (circled in red) with the application of a particular set field. Again as the field reaches opposite reset polarity, there will be the dissolution of the formed filament (Figure **S1c**). Figure **S1d** shows the further formation of the filament as the voltage again reaches its set threshold.

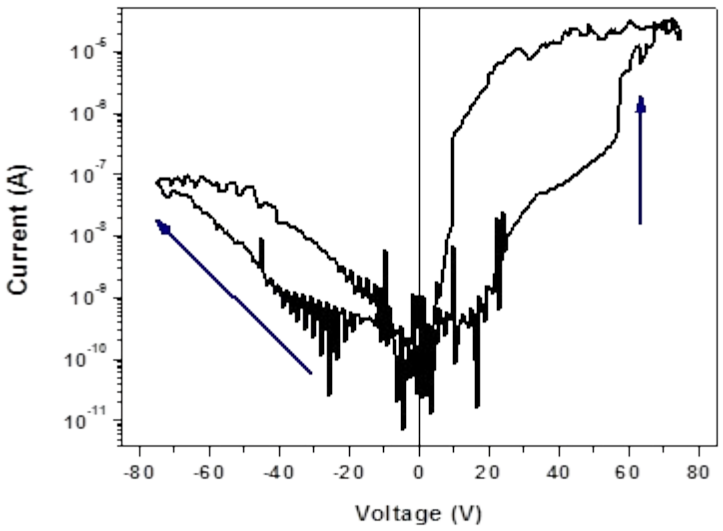

Figure S2 . Electrical characterization performed on the planar asymmetric RSD with PEO as switching matrix.

The electrical characterestics in Figure **S2** shows a clear volatile behaviour. Here as the switching matrix is composed of polymer PEO without any other additives, there is no facile path for the oxidised Ag ions from the active electrode. Thus the device sets at a relatively high field of about 60 kV/cm, and then resets as the field decreases and reaches around 15 kV/cm.

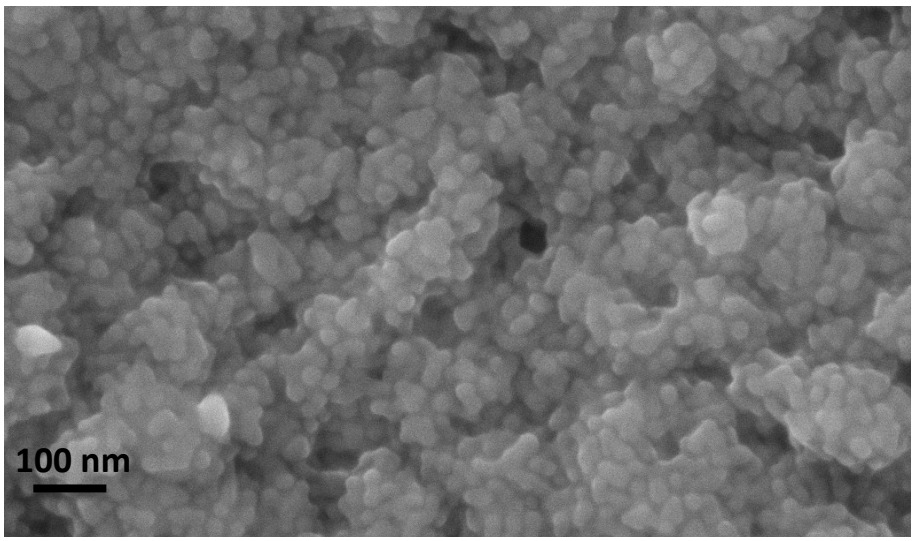

Figure S3 . FESEM showing the higher magnification image corresponding to figure 8a.