

## Electronic Supplementary Information

### Electrode dependence in halide perovskite memories: Resistive switching behaviours

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**Table S1.** Comparison table of resistive switching memories employing halide perovskites with various top electrodes.

| Device Structure  | Type of Resistive Switching | ON/OFF ratio        | Endurance (cycle) | Retention (s)    | Top Electrode | Ref |
|---|-----------------------------|---------------------|-------------------|------------------|---------------|-----|
| Au/MAPbI <sub>3</sub> /Au/SiO <sub>2</sub> /Si  | Unipolar                    | 10 <sup>8</sup>     | 1000              | >10 <sup>4</sup> | Au            | 1   |
| Au/MAPbI <sub>3</sub> /Au/Ti/SiO <sub>2</sub> /Si   | Unipolar                    | 3 x 10 <sup>7</sup> | 100               | >10 <sup>3</sup> | Au            | 2   |
| Ag/Bphen/MAPbBr <sub>3</sub> /PEDOT:PSS/ITO   | Unipolar                    | 80                  | 40                | 600              | Ag            | 3   |
| Au/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> /Pt/Ti/SiO <sub>2</sub> /Si               | Bipolar                     | >10 <sup>3</sup>    | 500               | >10 <sup>5</sup> | Au            | 4   |
| Au/A <sub>3</sub> Bi <sub>2</sub> I <sub>9</sub> /Pt/Ti/SiO <sub>2</sub> /Si                  | Bipolar                     | >10 <sup>7</sup>    | 400               | 10 <sup>3</sup>  | Au            | 5   |
| Au/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> /TiO <sub>2</sub> /FTO                    | Bipolar                     | 10 <sup>3</sup>     | 350               | >10 <sup>4</sup> | Au            | 6   |
| Au/Cs <sub>3</sub> Sb <sub>2</sub> I <sub>9</sub> /ITO  | Bipolar                     | -                   | 500               | 5000             | Au            | 7   |
| Au/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3-x</sub> Br <sub>x</sub> /ITO                    | Bipolar                     | >10 <sup>2</sup>    | -                 | >10 <sup>4</sup> | Au            | 8   |
| Ti/TiO <sub>2</sub> /CH <sub>3</sub> NH <sub>3</sub> PbCl <sub>1-x</sub> I <sub>3-x</sub> /Au | Bipolar                     | 20                  | -                 | >10 <sup>4</sup> | Au            | 9   |
| Au/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> /ITO/PET                                  | Bipolar                     | 10 <sup>4</sup>     | 400               | >10 <sup>4</sup> | Au            | 10  |
| Au/CsPb <sub>2</sub> Br <sub>5</sub> /ITO   | Bipolar                     | ~10 <sup>2</sup>    | 500               | 10 <sup>4</sup>  | Au            | 11  |
| Au/(ZnO)/MAPbI <sub>3</sub> /ITO  | Bipolar                     | -                   | 300               | >10 <sup>4</sup> | Au            | 12  |
| Au/Cs <sub>4</sub> PbBr <sub>6</sub> /PEDOT:PSS/ITO   | Bipolar                     | -                   | 100               | 10 <sup>4</sup>  | Au            | 13  |

|   |         |                      |                     |                                  |              |    |
|---|---------|----------------------|---------------------|----------------------------------|--------------|----|
| Au/Cs <sub>0.06</sub> FA <sub>0.78</sub> MA <sub>0.16</sub> Pb(I <sub>0.92</sub> Br <sub>0.08</sub> ) <sub>3</sub> /ITO | Bipolar | >10 <sup>2</sup>     | 10 <sup>3</sup>     | 10 <sup>5</sup>                  | Au           | 14 |
| Au/Cs <sub>3</sub> Sb <sub>2</sub> Br <sub>9</sub> /Au  | Bipolar | >10 <sup>3</sup>     | 200                 | 2 x 10 <sup>4</sup>              | Au           | 15 |
| Au/Cs <sub>2</sub> BiAgBr <sub>6</sub> /ITO   | Bipolar | 10 <sup>4</sup>      | 100                 | 10 <sup>3</sup>                  | Au           | 16 |
| Ag/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3-x</sub> Cl <sub>x</sub> /FTO  | Bipolar | -                    | 10 <sup>3</sup>     | 4 x 10 <sup>4</sup>              | Ag           | 17 |
| Ag/AZO/(C <sub>4</sub> H <sub>9</sub> NH <sub>3</sub> ) <sub>2</sub> PbBr <sub>4</sub> /Pt                              | Bipolar | 10 <sup>6</sup>      | 3 x 10 <sup>4</sup> | 5 x 10 <sup>4</sup>              | Ag           | 18 |
| ITO/PMMA/CH <sub>3</sub> NH <sub>3</sub> PbBr <sub>3</sub> :PMMA/PMMA/Ag  | Bipolar | >10 <sup>3</sup>     | -                   | 4000                             | Ag           | 19 |
| Ag/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> /Pt   | Bipolar | 10 <sup>6</sup>      | 10 <sup>3</sup>     | 29800                            | Ag           | 20 |
| Ag/CsPbBr <sub>3</sub> /Ag  | Bipolar | ~10 <sup>3</sup>     | 10 <sup>3</sup>     | >400                             | Ag           | 21 |
| FTO/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3-x</sub> Cl <sub>x</sub> /Ag Probe  | Bipolar | 10 <sup>6</sup>      | 10 <sup>4</sup>     | 2 x 10 <sup>3</sup>              | Ag           | 22 |
| Ag/(PEA) <sub>2</sub> Cs <sub>3</sub> Pb <sub>4</sub> I <sub>3</sub> /Pt/Ti/SiO <sub>2</sub> /Si                        | Bipolar | 10 <sup>9</sup>      | 200                 | 2000                             | Ag           | 23 |
| Ag/PMMA/PEA <sub>2</sub> PbI <sub>4</sub> /MAPbI <sub>3</sub> /Pt/Ti/SiO <sub>2</sub> /Si                               | Bipolar | >10 <sup>6</sup>     | 2700                | >10 <sup>3</sup>                 | Ag           | 24 |
| Ag/CsPbBr <sub>3</sub> /MoO <sub>3</sub> /Ag  | Bipolar | >100                 | 50                  | -                                | Ag           | 25 |
| Ag/BA <sub>2</sub> PbI <sub>4</sub> /Pt   | Bipolar | -                    | 250                 | 10 <sup>3</sup>                  | Ag           | 26 |
| Ag/CsSnBr <sub>3</sub> /Pt  | Bipolar | >10 <sup>2</sup>     | -                   | -                                | Ag           | 27 |
| Ag/BA <sub>2</sub> CsAgBiBr <sub>7</sub> /Pt  | Bipolar | 10 <sup>7</sup>      | ~1000               | 2 x 10 <sup>4</sup>              | Ag           | 28 |
| Ag/CsSnCl <sub>3</sub> /ITO   | Bipolar | 10 <sup>2</sup>      | 10 <sup>5</sup>     | >10 <sup>4</sup>                 | Ag           | 29 |
| Ag/PMMA/CsSnI <sub>3</sub> /Pt/Ti/SiO <sub>2</sub> /Si  | Bipolar | >10 <sup>3</sup>     | 600                 | 7 x 10 <sup>3</sup>              | Ag           | 30 |
| Au/PMMA/CsSnI <sub>3</sub> /Pt/Ti/SiO <sub>2</sub> /Si  |         | >5 x 10 <sup>2</sup> | 120                 | -                                |              |    |
| Al/CsPbBr <sub>3</sub> /PEDOT:PSS/ITO/PET   | Bipolar | ~10 <sup>2</sup>     | 50                  | -                                | Al           | 31 |
| Al/PMMA/CsPbCl <sub>3</sub> /PMMA/ITO   | Bipolar | 2 x 10 <sup>4</sup>  | 95                  | 1 x 10 <sup>4</sup>              | Al           | 32 |
| Al/Cs <sub>3</sub> Cu <sub>2</sub> I <sub>5</sub> /ITO  | Bipolar | ~65                  | 200                 | 10 <sup>4</sup>                  | Al           | 33 |
| ITO/MAPbI <sub>3-x</sub> Cl <sub>x</sub> /2D perovskite/Al  | Bipolar | >10 <sup>3</sup>     | 10 <sup>4</sup>     | 3 x 10 <sup>2</sup>              | Al           | 34 |
| Al@MAPbI <sub>3</sub> /Al   | Bipolar | ~10 <sup>6</sup>     | 500                 | >10 <sup>4</sup>                 | Al           | 35 |
| ITO/FA-MA-Cs tri-cation perovskite/PMMA/Al  | Bipolar | >10 <sup>3</sup>     | 130                 | 10 <sup>4</sup>                  | Al           | 36 |
| ITO/MAPbI <sub>3</sub> -TiO <sub>2</sub> /PMMA/Al   | Bipolar | -                    | 50                  | 10 <sup>3</sup> ~10 <sup>4</sup> | Al           | 37 |
| Al/CsBi <sub>3</sub> I <sub>10</sub> /ITO   | Bipolar | 10 <sup>3</sup>      | 150                 | 10 <sup>4</sup>                  | Al           | 38 |
| Al/PCBM/Cs <sub>3</sub> Sb <sub>2</sub> I <sub>9</sub> /PEDOT:PSS:ITO   | Bipolar | ~10 <sup>4</sup>     | 100                 | >10 <sup>4</sup>                 | Al           | 39 |
| ITO/PEI/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> /PEI/metal   | Bipolar | 20                   | 4000                | -                                | InGA, Al, Au | 40 |
| Pt/CsPbBr <sub>3</sub> /Cu <sub>2</sub> O/FTO   | Bipolar | 10 <sup>3</sup>      | 1000                | -                                | Pt           | 41 |

|   |            |                  |                       |                       |    |    |
|---|------------|------------------|-----------------------|-----------------------|----|----|
| FTO/ZnO/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>1-x</sub> Bi <sub>x</sub> Br <sub>3</sub> /Pt  | Bipolar    | 10 <sup>5</sup>  | 100                   | -                     | Pt | 42 |
| Pt/Cs <sub>2</sub> AgBiBr <sub>6</sub> /ITO /   | Bipolar    | ~100             | >500                  | >2400                 | Pt | 43 |
| Pt/CsSnBr <sub>3</sub> /Pt  | Bipolar    | >10 <sup>5</sup> | 50                    | 10 <sup>4</sup>       | Pt | 44 |
| Ni/ZnO/CsPbBr <sub>3</sub> /FTO   | Bipolar    | >10 <sup>5</sup> | 100                   | >10 <sup>4</sup>      | Ni | 45 |
| FTO/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> /W   | Bipolar    | >10 <sup>2</sup> | 100                   | -                     | W  | 46 |
| Cu/MA <sub>3</sub> Bi <sub>2</sub> I <sub>9</sub> /ITO  | Bipolar    | 10 <sup>4</sup>  | 1730                  | 3 x 10 <sup>5</sup>   | Cu | 47 |
| Ag/PMMA/4wt%-RbPbI <sub>2.4</sub> Cl <sub>0.6</sub> @PMMA/ITO   | Bipolar    | >10 <sup>3</sup> | 1000                  | 10 <sup>4</sup>       | Ag | 48 |
| Ag/PMMA/6wt%-RbPbI <sub>2.4</sub> Cl <sub>0.6</sub> @PMMA/ITO   | Worm       | -                | -                     | -                     | -  | -  |
| ITO/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> /Al  | Bipolar    | -                | -                     | -                     | Al | -  |
| ITO/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> /Ag  | WORM       | -                | -                     | -                     | Ag | 49 |
| ITO/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> /Au  | WORM       | -                | -                     | -                     | Au | -  |
| Au/FAMAPbI <sub>3</sub> /ITO  | WORM       | 40               | -                     | 10 <sup>2</sup>       | Au | 50 |
| Au/(RNH <sub>3</sub> ) <sub>2</sub> (FA) <sub>1</sub> Pb <sub>2</sub> Br <sub>7</sub> /ITO  | WORM       | 10 <sup>2</sup>  | -                     | 10 <sup>4</sup>       | Au | 51 |
| Au/MAPbBr <sub>3</sub> /ITO   | WORM       | 10 <sup>6</sup>  | -                     | 10 <sup>4</sup>       | Au | 52 |
| Au/CsPbBr <sub>3</sub> /ITO   | WORM       | 10 <sup>4</sup>  | -                     | >10 <sup>3</sup>      | Au | 53 |
| ITO/CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3</sub> :PVK/Al  | WORM       | >10 <sup>3</sup> | -                     | -                     | Al | 54 |
| Al/MAPbBr <sub>3</sub> :PEO/Al  | WORM       | 10 <sup>4</sup>  | -                     | 10 <sup>4</sup>       | Al | 55 |
| Al/(CH <sub>3</sub> NH <sub>3</sub> ) <sub>2</sub> PbI <sub>2</sub> (SCN) <sub>2</sub> /ITO   | WORM       | 10 <sup>3</sup>  | -                     | 10 <sup>4</sup>       | Al | 56 |
| Au/PMMA/AgBiI <sub>7-3</sub> Cs <sub>3</sub> Bi <sub>2</sub> I <sub>9</sub> /Pt   | Multilevel | >10 <sup>7</sup> | 10 <sup>3</sup>       | >5 x 10 <sup>4</sup>  | Au | 57 |
| Au/MA <sub>3</sub> Bi <sub>2</sub> I <sub>9</sub> /ITO  | Multilevel | 100              | 300                   | ~10 <sup>4</sup>      | Au | 58 |
| Au/CsPbBr <sub>3</sub> /ITO   | Multilevel | 10 <sup>7</sup>  | -                     | >10 <sup>3</sup>      | Au | 59 |
| Au/CsPbBr <sub>3</sub> /FTO   | Multilevel | ~10 <sup>5</sup> | 1000                  | >10 <sup>4</sup>      | Au | 60 |
| Au/KCl-CH <sub>3</sub> NH <sub>3</sub> PbI <sub>3-x</sub> Cl <sub>x</sub> /ITO  | Multilevel | -                | 140                   | >10 <sup>3</sup>      | Au | 61 |
| (ITO)/CsSnBr <sub>3</sub> /Au   | Multilevel | ~10 <sup>5</sup> | 400                   | ~10 <sup>3</sup>      | Au | 62 |
| Ag/CsPb <sub>1-x</sub> Bi <sub>x</sub> I <sub>3</sub> /ITO  | Multilevel | -                | 250                   | ~10 <sup>4</sup>      | Ag | 63 |
| Ag/PMMA/[C <sub>6</sub> H <sub>5</sub> (CH <sub>2</sub> ) <sub>n</sub> NH <sub>3</sub> ]CuBr <sub>4</sub> /Pt/Ti/SiO <sub>2</sub> /Si | Multilevel | ~10 <sup>8</sup> | 2000                  | >10 <sup>2</sup>      | Ag | 64 |
| Pt/oxide-passivated MAPbI <sub>3</sub> /PMMA/Ag   | Multilevel | 10 <sup>6</sup>  | 5.7 x 10 <sup>4</sup> | 7.8 x 10 <sup>4</sup> | Ag | 65 |
| Ag/CsPbBr <sub>3</sub> /Pt  | Multilevel | ~10 <sup>4</sup> | -                     | >5 x 10 <sup>4</sup>  | Ag | 66 |
| Ag/FAPbI <sub>3</sub> /Pt   | Multilevel | >10 <sup>5</sup> | 1200                  | 3000                  | Ag | 67 |

|  |            |                  |                 |                  |     |    |
|--|------------|------------------|-----------------|------------------|-----|----|
| Ag(AgO <sub>x</sub> )/Cs <sub>3</sub> Bi <sub>2</sub> I <sub>10</sub> /FTO                   | Multilevel | ~10 <sup>6</sup> | 250             | >10 <sup>3</sup> | Ag  | 68 |
| Ag(AgO <sub>x</sub> )/Cs <sub>3</sub> Bi <sub>2</sub> I <sub>9</sub> /FTO                    |            |                  |                 | <10 <sup>3</sup> |     |    |
| Ag/PMMA/CsPbI <sub>3</sub> /Pt/Ti/SiO <sub>2</sub> /Si                                       | Multilevel | >10 <sup>6</sup> | 300             | 1000             | Ag  | 69 |
| Al/CsPbCl <sub>x</sub> Br <sub>3-x</sub> , (x = 3, 1.5, 0)/ITO/PET                           | Multilevel | ~10 <sup>3</sup> | 10 <sup>3</sup> | >10 <sup>3</sup> | Al  | 70 |
| Al/RbPbBr <sub>3</sub> /ITO/PET  | Multilevel | 10 <sup>3</sup>  | 1000            | ~10 <sup>4</sup> | Al  | 71 |
| NiO/(C <sub>4</sub> H <sub>9</sub> NH <sub>3</sub> ) <sub>2</sub> PbBr <sub>4</sub> /ZnO/FTO | Multilevel | -                | -               | -                | NiO | 72 |
| Pt/Cs <sub>2</sub> AgBiBr <sub>6</sub> /ITO  | Multilevel | 500              | -               | 1200             | Pt  | 73 |

\*MA = CH<sub>3</sub>NH<sub>3</sub>, FA = HC(NH<sub>2</sub>)<sub>2</sub>

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