Supplementary Information

Mechanochemically-Assisted Synthesis of 3D, 2D and quasi 2D Lead Halide Perovskites for Supercapacitor Application

Apurba Mahapatra,[a] Manoranjan Mandal,[b] Ayon Das Mahapatra,[c] Vishnu Anilkumar,[a] Jan Nawrocki,[a] Rohit D. Chavan,[a] Pankaj Yadav[d,*] and Daniel Prochowicz[a,*]*

[a] Institute of Physical Chemistry, Polish Academy of Sciences, Kasprzaka 44/52, 01-224 Warsaw, Poland.

[b] Department of Physics, School of Science, GITAM University, Bengaluru, 561203, India.

[c] Institute of Chemistry, Hebrew University of Jerusalem, Jerusalem- 9190401, Israel.

[d] Department of Solar Energy, School of Energy Technology, Pandit Deendayal Energy University, Gandhinagar-382 007, Gujarat, India.

Corresponding authors: amahapatra@ichf.edu.pl; pankaj.yadav@sse.pdpu.ac.in; dprochowicz@ichf.edu.pl

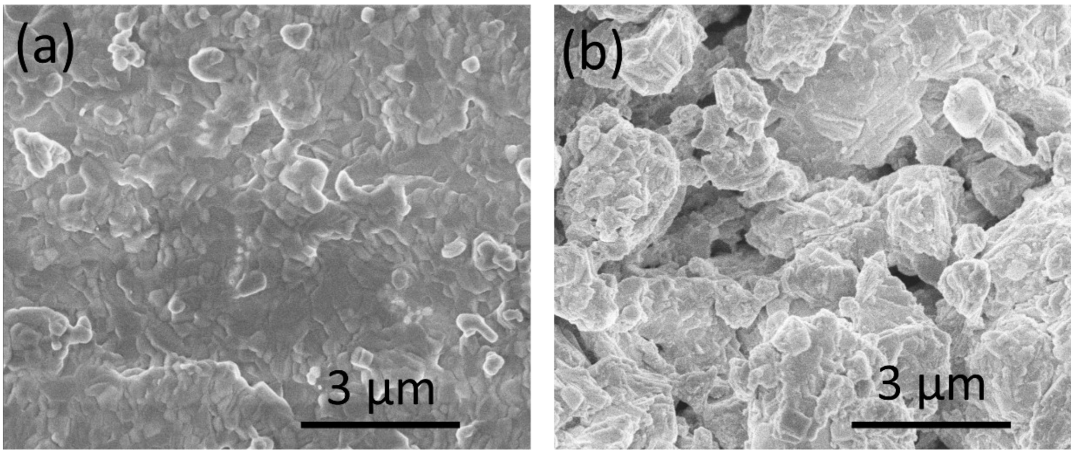

Figure S1. SEM images of the synthesized (a) BA_2PbBr_4 (2D) and (b) $BA_2MAPb_2Br_7$ (2D/3D) MSP.

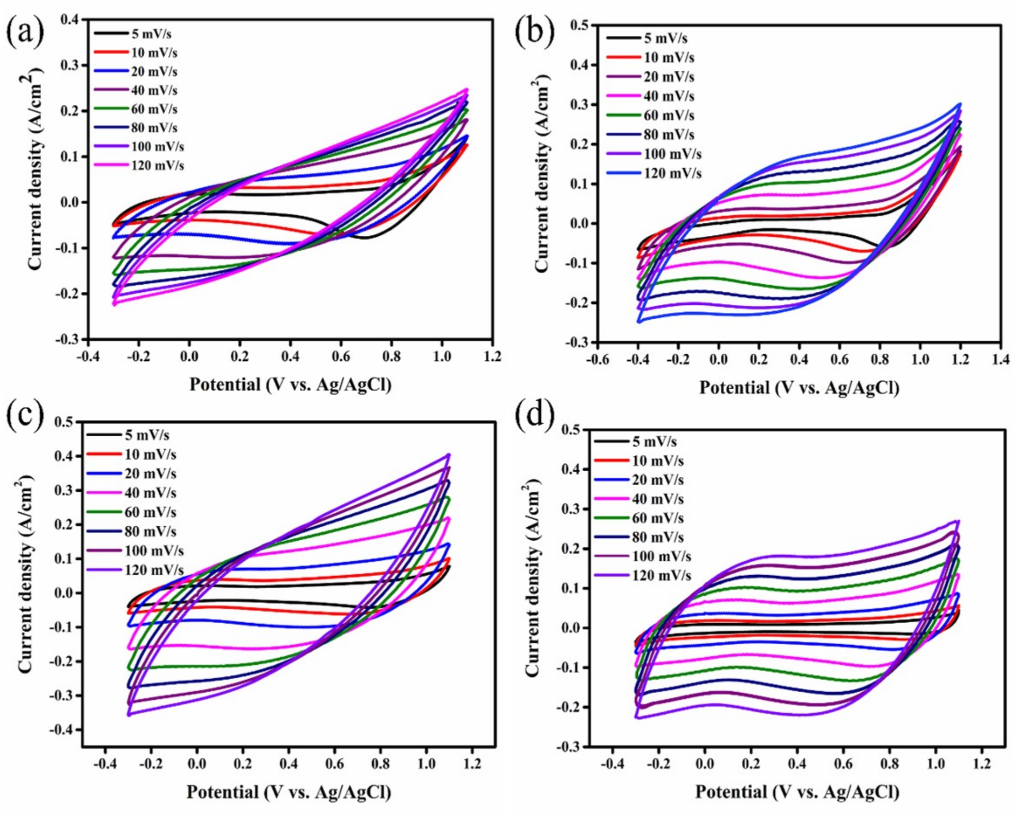

Figure S2. Cyclic-voltammetry (CV) curves of (a) $MAPbBr_3$ SCP, (b) $MAPbBr_3$ MSP, (c) BA_2PbBr_4 (2D) MSP, and (d) $BA_2MAPb_2Br_7$ (quasi-2D) MSP electrode recorded at different scan rates.

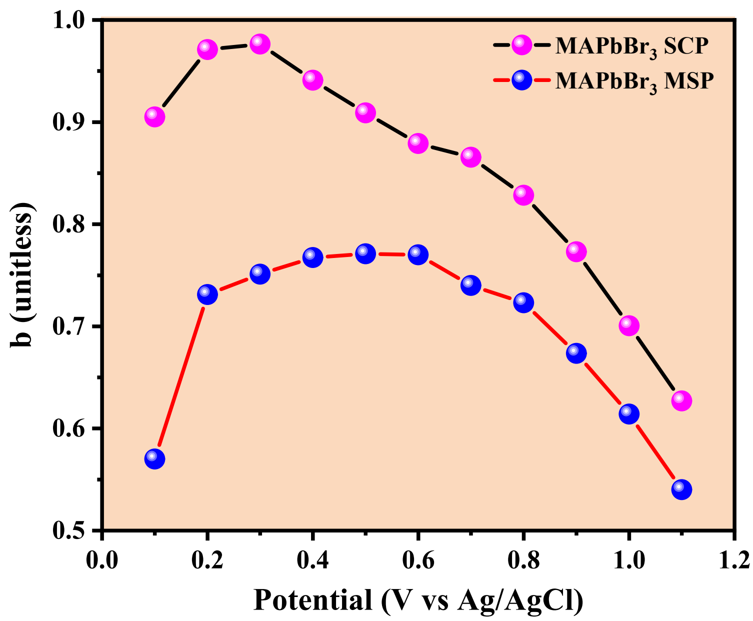

Figure S3. Applied potential dependent change in Dunn law coefficient b of $MAPbBr_3$ SCP and MSP electrodes.

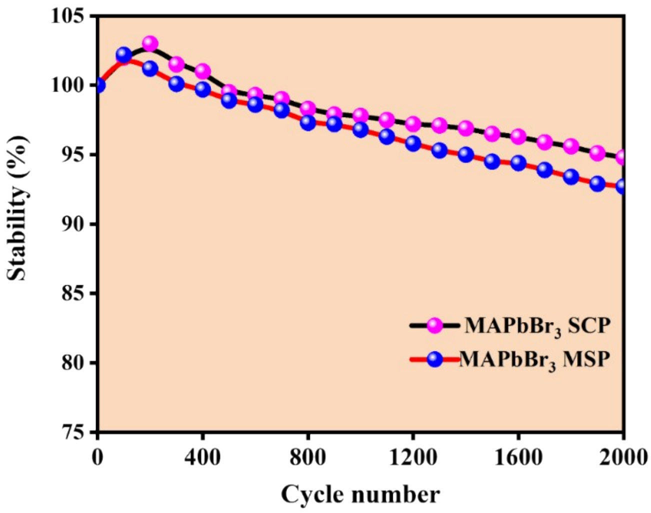

Figure S4. Cyclic stability of $MAPbBr_3$ SCP and MSP electrode.

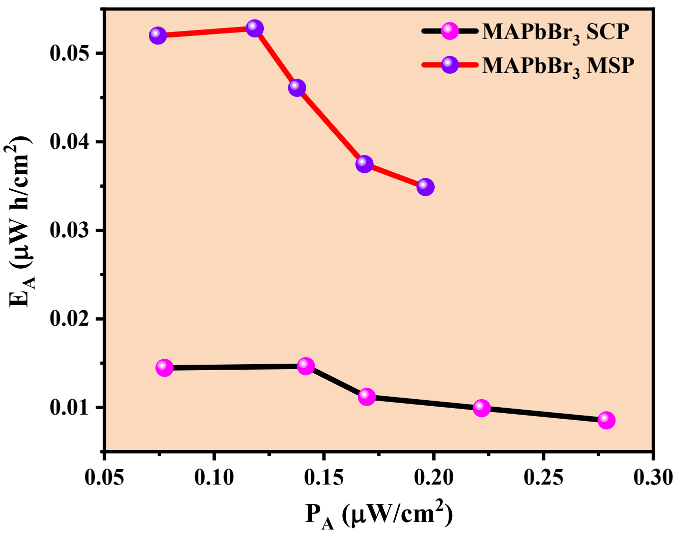

Figure S5. Ragone plot of $MAPbBr_3$ SCP and MSP electrodes.

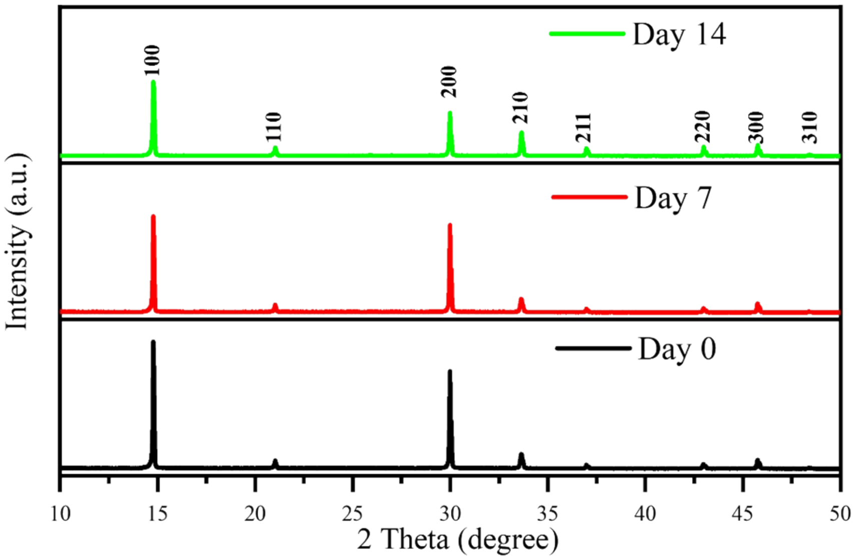

Figure S6. XRD patterns of the of fresh and aged $MAPbBr_3$ MSP based electrode stored at ambient conditions.

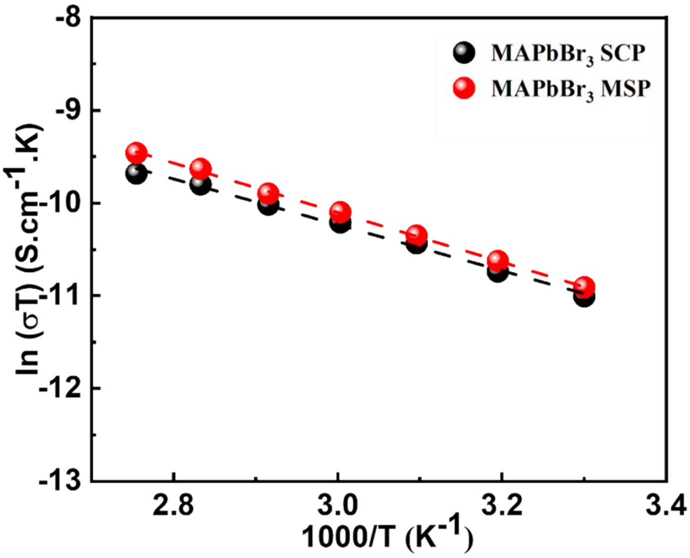

Figure S7. The temperature-dependent conductivity of $MAPbBr_3$ SCP and MSP pellets.

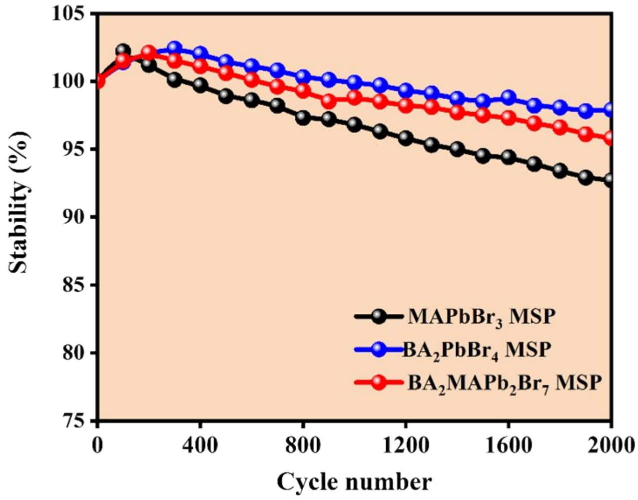

Figure S8. Cyclic stability of $MAPbBr_3$, BA_2PbBr_4, and $BA_2MAPb_2Br_7$ MSP-based electrodes.

Table S1. Comparison of the electrochemical performances of various LHP based electrodes in terms of capacitance and cycling stability.

Materials (LHPs)	**Capacitance from CV**	**Capacitance from GCD**	**Stability**	**Ref.**
$MAPbBr_3$ single crystal	81.5 mF cm^{-2} @5 mV/s	61.2 mF. cm^{-2} @0.3A/g	97% after 1500 cycles	1
$MAPbBr_3$ thin film	39.8 µF cm^{-2} @5 mV/s	-	Degraded after few cycles	
$MAPbBr_3$ single crystal	58.5 mF cm^{-2} @5 mV/s	60 mF. cm^{-2} @0.6 mA cm^{-2}	98% after 1000 cycles	2
$MAPbI_3$ thin film	21.5 µF cm^{-2} @10 mV/s	-	92.3% after 3000 cycles	3
$MAPbBr_3$ SCP	75 mF cm^{-2} @5 mV/s	50.22 F g^{-1} @0.2 mA cm^{-2}	95% after 2000 cycles	This Work
$MAPbBr_3$ MSP	159 mF cm^{-2} @5 mV/s	98.38 F g^{-1} @0.2 mA cm^{-2}	93% after 2000 cycles	
PEA_2PbBr_4 thin film	24.5 mF cm^{-2} @5 mV/s	25 mF. cm^{-2} @0.6 mA cm^{-2}	100% after 1000 cycles	2
MA_2PbBr_4 (2D) MSP	209 mF cm^{-2} @5 mV/s	mF. cm^{-2} @0.2 mA cm^{-2}	98% after 2000 cycles	This Work
$BA_2MAPb_2Br_7$ (2D/3D) MSP	205 mF cm^{-2} @5 mV/s	mF. cm^{-2} @0.2 mA cm^{-2}	96% after 2000 cycles	

References

1 R. Kumar, P. S. Shukla, G. D. Varma and M. Bag, *Electrochim. Acta*, 2021, **398**, 139344.

2 R. Kumar and M. Bag, *J. Phys. Chem. C*, 2021, **125**, 16946–16954.

3 L. E. Oloore, M. A. Gondal, A. J. Popoola and I. K. Popoola, *Electrochim. Acta*, 2020, **361**, 137082.