Supporting Information

Electrochemical Synthesis of Au-MnO_2 on Electrophoretically Prepared Graphene Nanocomposite for High performance Supercapacitor and Biosensor Applications†

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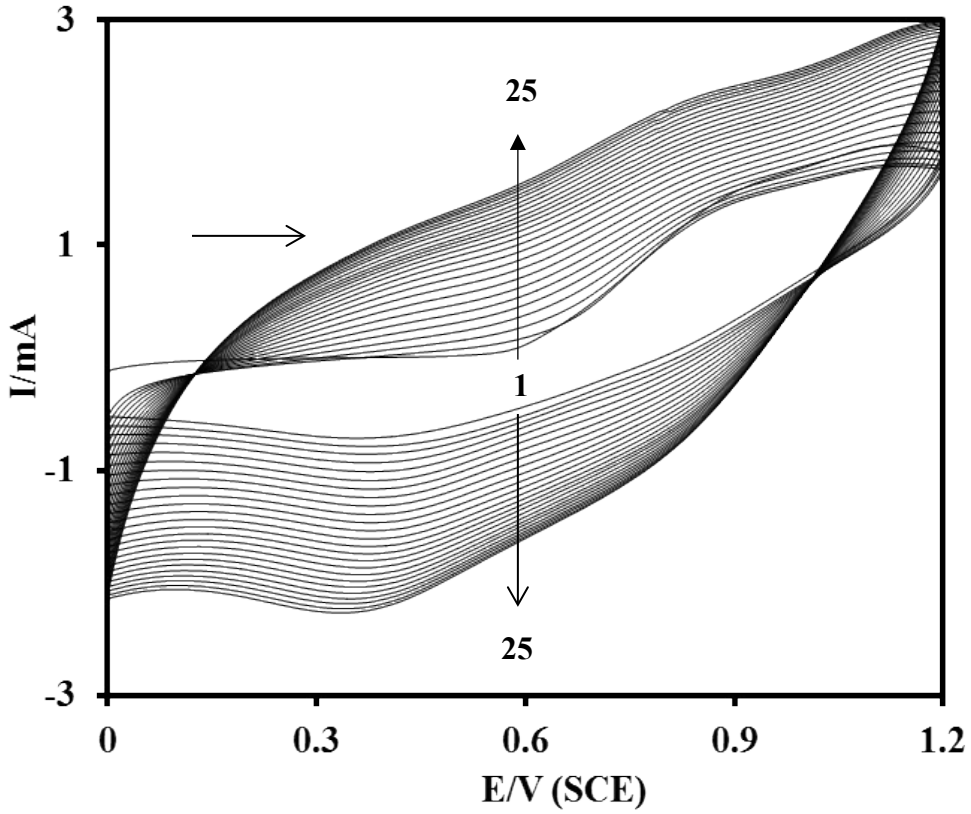

Fig. S1 Consecutive cyclic voltammograms of MnO_2-Au co-deposition on EPD graphene modified SS substrate. Electrolyte: 0.01 mM $HAuCl_4$ and 10 mM $Mn(OAc)_2$ in 100 mM Na_2SO_4 aqueous solution, Scan rate : 50 mV S^{-1}.

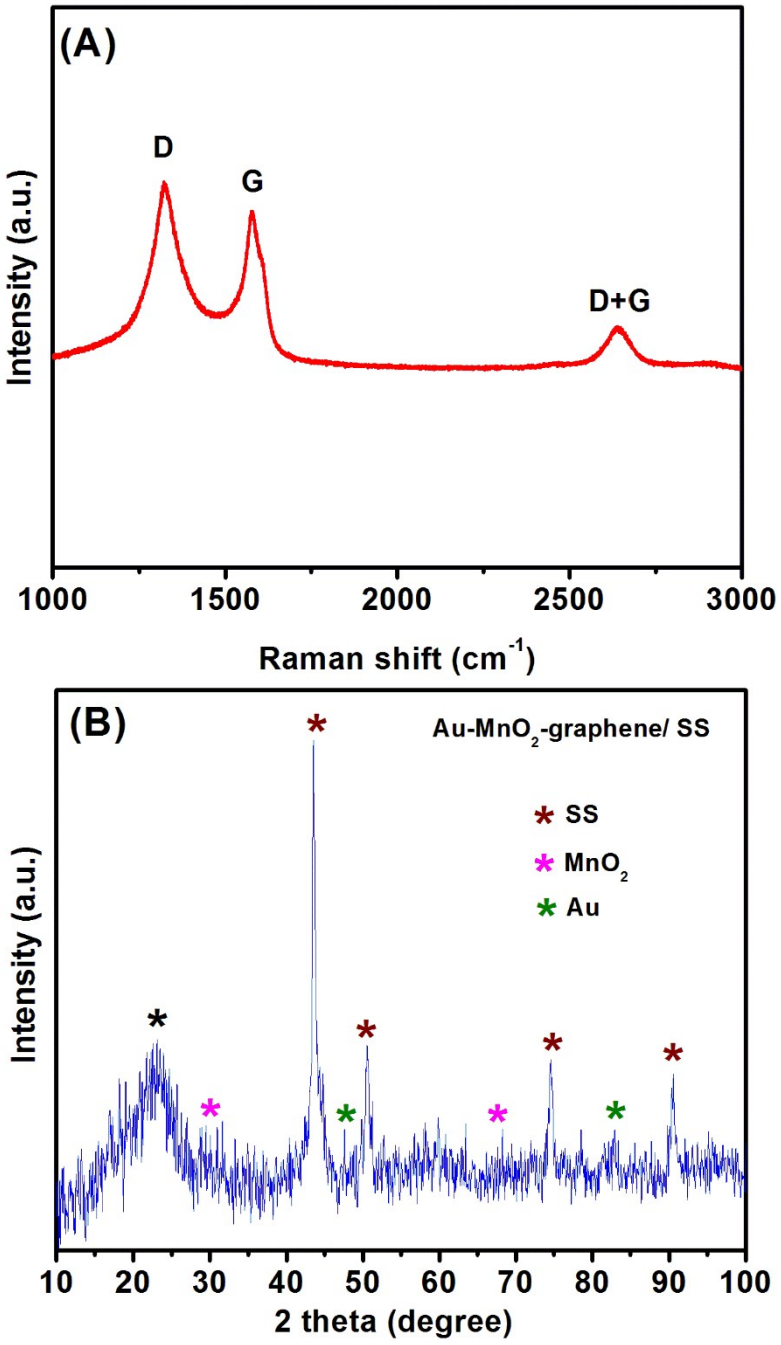

Fig. S2 (A) The Raman spectra of electrophoretically prepared graphene. (B) XRD pattern of Au-MnO_2–graphene /SS.

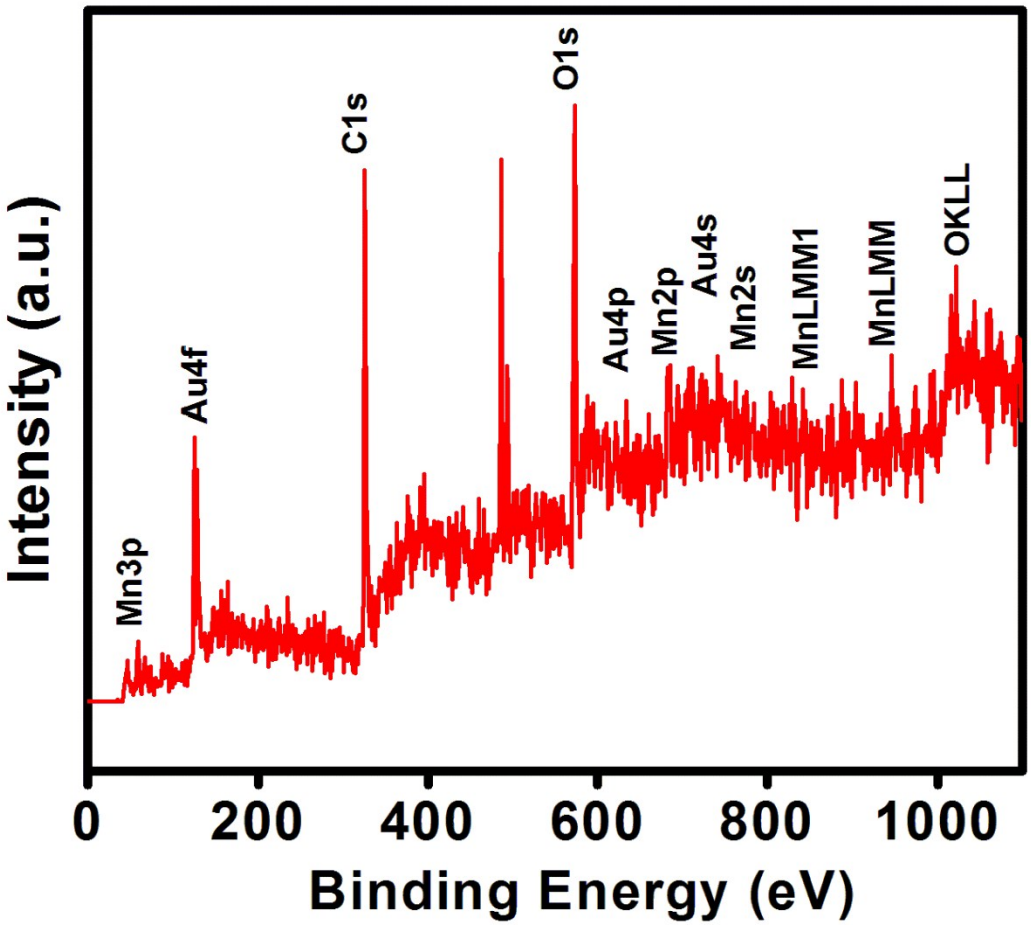

Fig. S3 The full range of XPS for Au-MnO_2–graphene.

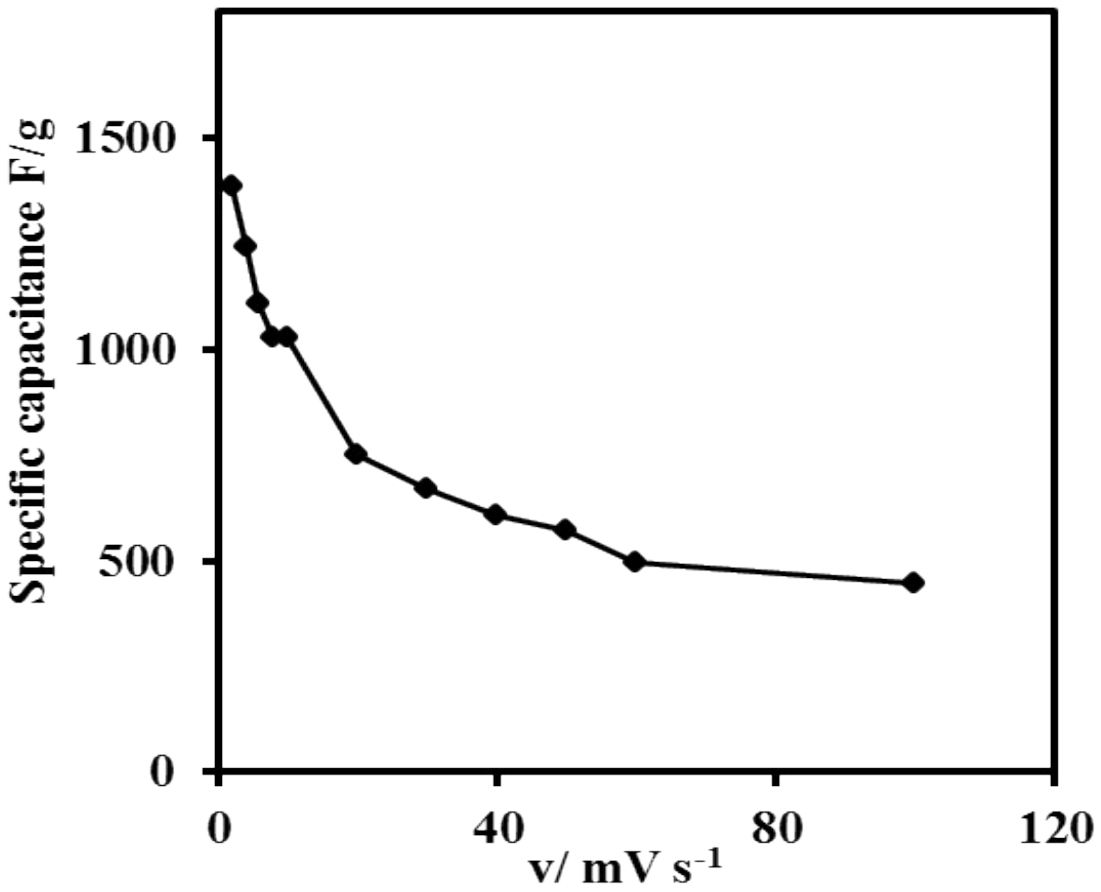

Fig. S4 Plot of specific capacitance against sweep rate.

Table S1. The calculated specific capacitance of the different electrodes.

S.No	Electrode Materials	Calculated Specific capacitance (F/g)
1	Au-MnO_2	177
2	MnO_2/graphene	447
3	Au-MnO_2–graphene	575

Table S2. The Characteristics of chemically prepared MnO_2-graphene nanocomposites.

S. No	Preparation Method	Morphology	Electrolyte	Potential Window (V) / current load (A g^{-1})/ scan rate (mV s^{-1})	Specific Capacitance (F g^{-1})	Ref.
1	Chemical	Nanoparticles	1 M Na_2SO_4	0 – +1/ -/ 10	324	[S1]
2	Chemical	Needle	1 M Na_2SO_4	0 – +1/ 0.2/ -	197	[S2]
3	Chemical	Nanowires	1 M Na_2SO_4	0 − +2.0/ -/ 10	31	[S3]
4	Chemical	Nano needle	1M Na_2SO_4	-0.1 − +0.9/ -/ 10	328	[S4]
5	Hydrothermal	Nano flowers	1 M Na_2SO_4	-0.2 – +0.8/ 2/ -	560	[S5]
6	Hydrothermal	Nanorods	2 M $(NH_4)_2SO_4$	0 − +1/ -/ 10	276	[S6]
7	Hydrothermal	-	1 M Na_2SO_4	-0.2 − +0.8/ 5/ -	263	[S7]
8	Electrostatic Adsorption	Nanoparticles	0.1 M Na_2SO_4	0 − +8/ -/ 2	206	[S8]
9	Electrostatic interaction	Honeycomb	0.5 M Na_2SO_4	0 − +1/ -/ 0.5	210	[S9]
10	Stirring and Refluxing	Nanoneedles	1M Na_2SO_4	0 − +1/ -/ 200	124	[S10]
11	Self-controlled redox deposition	-	1 M H_2SO_4	0 − +1/ 0.25/ -	850	[S11]
12	Co-precipitation		1 M KOH	-0.8 − +0.1/ 1/ -	367	[S12]

References

(S1) Y. Qian, S. Lu and F.Gao, *J. Mater. Sci.* 2011, **46**, 3517-3522.

(S2) S. Chen, J. Zhu, X. Wu, Q. Han and X. Wang, *ACS Nano,* 2010, **4**, 2822-2830.

(S3) Z. S. Wu, W. Ren, D.W. Wang, F. Li, B. Liu and H. M. Cheng, *ACS Nano,* 2010, **4**, 5835-5842.

(S4) M. Kim, Y. Hwang and J. Kim, *J. Power Sources,* 2013, **239**, 225-233.

(S5) X. Dong, X. Wang, J. Wang, H. Song, X. Li, L, Wang, M. C. Park, C. M. Li and P. Chen, *Carbon,* 2012, **50**, 4865-4870.

(S6) J. Yan, Z. Fan, T. Wei, Z. Qie, S. Wang and M. Zhang, *Mater. Sci. Eng. B*, 2008, **151**, 174-178.

(S7) W. Yang, Z. Gao, J. Wang, B. Wang, Q. Liu, Z. Li , T. Mann, P. Yang, M. Zhang and L. Liu, *Electrochim, Acta,* 2012, **69**, 112-117.

(S8) D. Zhai, B. Li, H. Du, G. Gao, L. Gan, Y. He, Q. Yang and F. Kang, *Carbon,* 2012, **50**, 5034-5043.

(S9) J. Zhu and J. He, *ACS Appl. Mater. Interfaces,* 2012, **4**, 1770-1776.

(S10) Y. Li, N. Zhao, C. Shi, E. Liu and C. He, *J. Phys. Chem. C,* 2012, **116**, 25226-25232.

(S11) X. Zhao, L. Zhang, S. Murali, M. D. Stoller, Q. Zhang, Y. Zhu and R. S. Ruoff, *ACS Nano,* 2012, **6**, 5404-5412.

(S12) M. Pang, G. Long, S. Jiang, Y. Ji, W. Han, B. Wang, X. Liu and Y. Xi. *Materials Science and Engineering B* 2015, **194,** 41–47.