Supporting Information

Polythiophene-nanoWO_3 Bilayer as Electrochromic Infrared Filter: An Optically Transparent Heat Shield

Anjali Chaudhary[1], Devesh K. Pathak[1], Manushree Tanwar[1], Julian Koch, H. Pfnür[2] and Rajesh Kumar[1,*]

[1] Material Research Laboratory, Discipline of Physics & MEMS, Indian Institute of Technology Indore, Simrol-453552, India

[2] Institut für Festkörperphysik, Leibniz Universität Hannover, Appelstr. 2, D-30167 Hannover, Germany

*Corresponding author e-mail: rajeshkumar@iiti.ac.in

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WO_3 synthesis procedure:

1. 1.25 g of H_2WO_4 was added to a solution of 30 mL water and 10 mL H_2O_2 under stirring at 90^{0}C.
2. The above solution turned transparent after few minutes then dilute it with water to make 0.05 M.
3. A second aqueous solution (3mL) was prepared by adding 0.035 g of $SC(NH_2)_2$ and 0.040 g of $C_4H_4O_4$.
4. Then add aqueous HCl (3M, 2mL), CH_3CN (18mL) and the (0.05M, 1mL) H_2WO_4 solution prepared in step 2 to the above solution.
5. The resultant solution was transferred to a teflon lined auto clave containing FTO glass substrates and heated in an oven at 180^{0}C for 3 hours. Allow it to cool at room temperature and substrates were rinsed with water and oven dried for 1 hour at 50^{0}C.

Steps involved in device fabrication:

1. FTO coated glass substrate has been spin coated with 0.06 wt% of P3HT in DCB at 600 rpm for 120 seconds and annealed at 50^{0}C for 1 hour.
2. The above P3HT deposited FTO substrate is sandwiched with WO_3 substrate (fabricated using above recipe) with the help of a patterned double sided tape.
3. $LiClO_4$ in PEO matrix is used as an electrolyte filled in between two substrates in above fabricated device.

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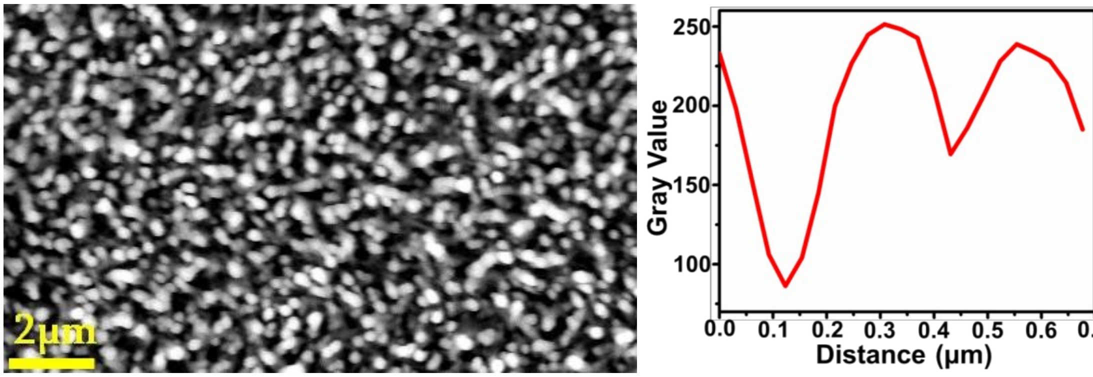

Figure S1: SEM image and corresponding line profile analysis using Image J.

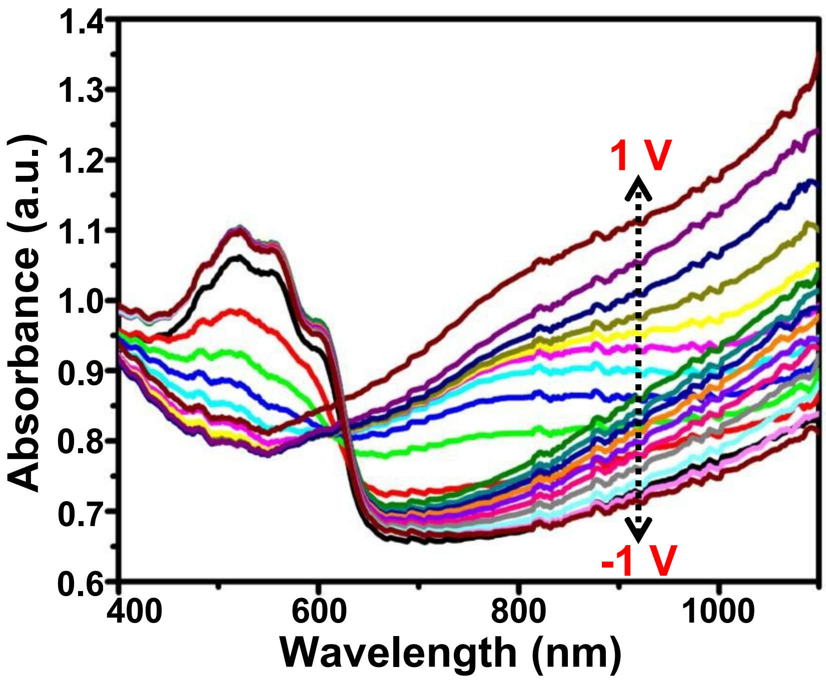

Figure S2: In situ Visible Infrared spectra of device with various applied bias ranging from 1 V to -1V.

Table S1: Comparison of heat shielding parameters of electrochromic device containing tungsten as one of the element.

S. No.	Device composition	Voltage (V)	Switching time (s)	Δ A	Colour of device during absorbtion of IR	Reference
1.	P3HT/WO_3	±1V	0.05	0.4	Transparent	This work
2.	$P_8W_{48}/W_{18}O_{49}$	-1 V &0.4 V	86	0.8	Blue	Gu et al[1]
3.	$W_{18}O_{49}$	1.5V &-1V	8	0.3	Blue	Li et al[2]
4.	WO_3/PEDOT:PSS	±1V	1.2	0.4	Dark blue	Jian et al[3]
5.	$WO_3.2H_2O$	±3V	9.7	0.6	Blue	Liang et al[4]

Table S2: Comparison e electrochromic performance of various hybrid devices.

S. No.	Device composition	Switching time (s)	Voltage (V)	CE (cm^2/C)	References
1.	P3HT/WO_3	0.05	1	378	This work
2.	WO_3/PANI	0.5	2	312	Eran et al[5]
3.	WO_3/RGO/Ag NW	8	1	53.1	Mallikarjuna et al[6]
4.	PEDOT/graphene/Ag NW	4.1	-1	NR	Deng et al[7]
5.	Ag NW/WO_3	1.7	1	80.2	Shen et al[8]
6.	Mesoporous WO_3	2.4	-2	79.7	Wang et al[9]
7.	WO_3/PEDOT	NR	2	NR	Dulgerbaki et al[10]
8.	P3HT/WO_3	1.3	1	NR	Kim etal[11]
9.	P3HT/GO	20	2	NR	Kim et al[12]
10.	WO_3/V_2O_5	4.4	1.5	87.1	Tang et al[13]

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