Supporting Information

A composite approach to synthesize highly performed Pt/WO_3-Carbon catalyst for optical and electrocatalytic properties

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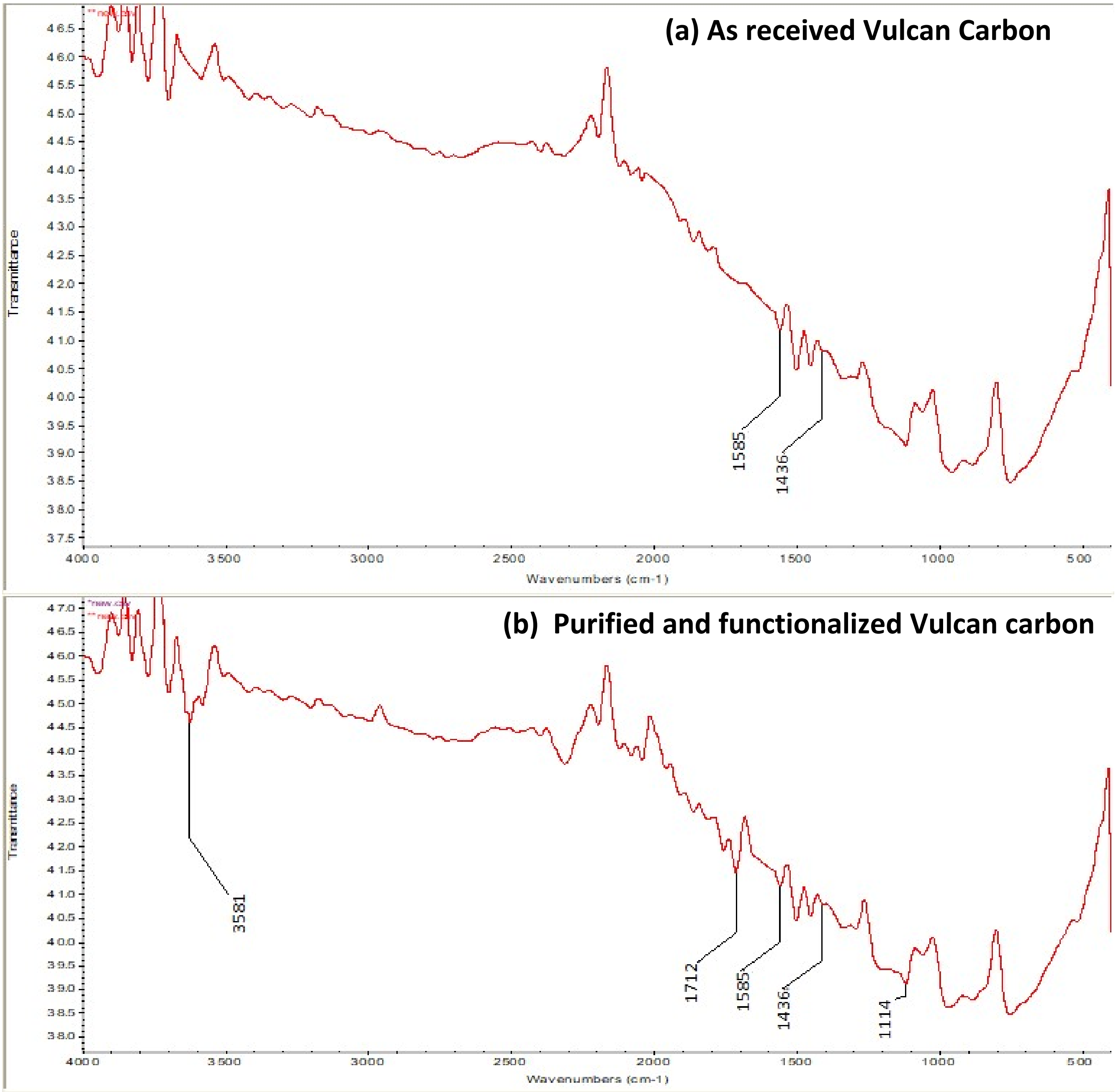

Figure S1: FTIR spectra of as (a) received (b) purified and functionalized vulcan carbon

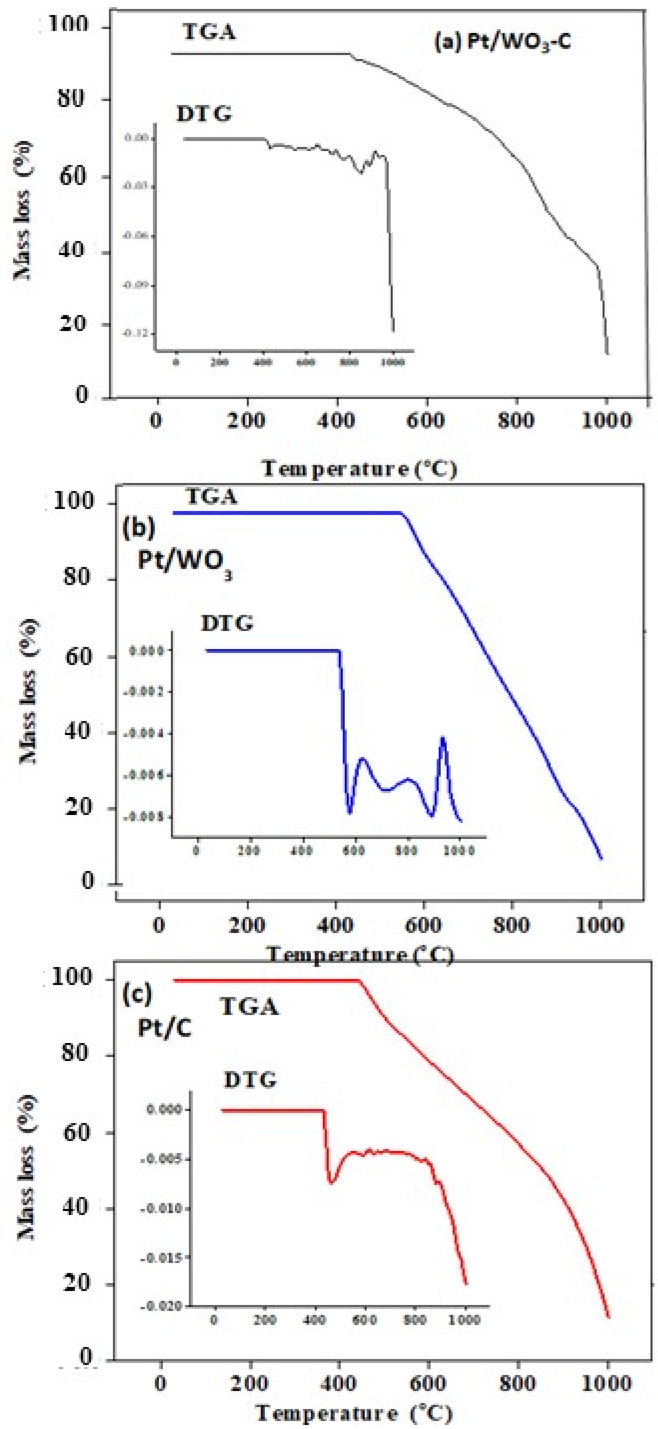

Figure S2: TGA and DTG of Pt-WO_3/C, Pt/WO_3, and Pt/C catalysts in air, heating rate 20 ^{o}C/min

Table S1: Optimization data of Catalysts with different composition having Electrochemical surface area (ECSA) and peak current

Catalyst	***%w/w Pt in Catalyst***	***%w/w WO_3 in Catalyst***	***%w/w C in Catalyst***	***ECSA m_2/g***	***Peak current mA/cm^2***
PWC 1 *Pt/WO_3-C*	5	15	80	362	*17*
PWC 2 *Pt/WO_3-C*	10	10	80	498	*28*
PWC 3 *Pt/WO_3-C*	15	5	80	472	*26*
Pt/WO_3	10	90	n/a	447	*12*
Pt/C	Pt	n/a	90	132	*4*

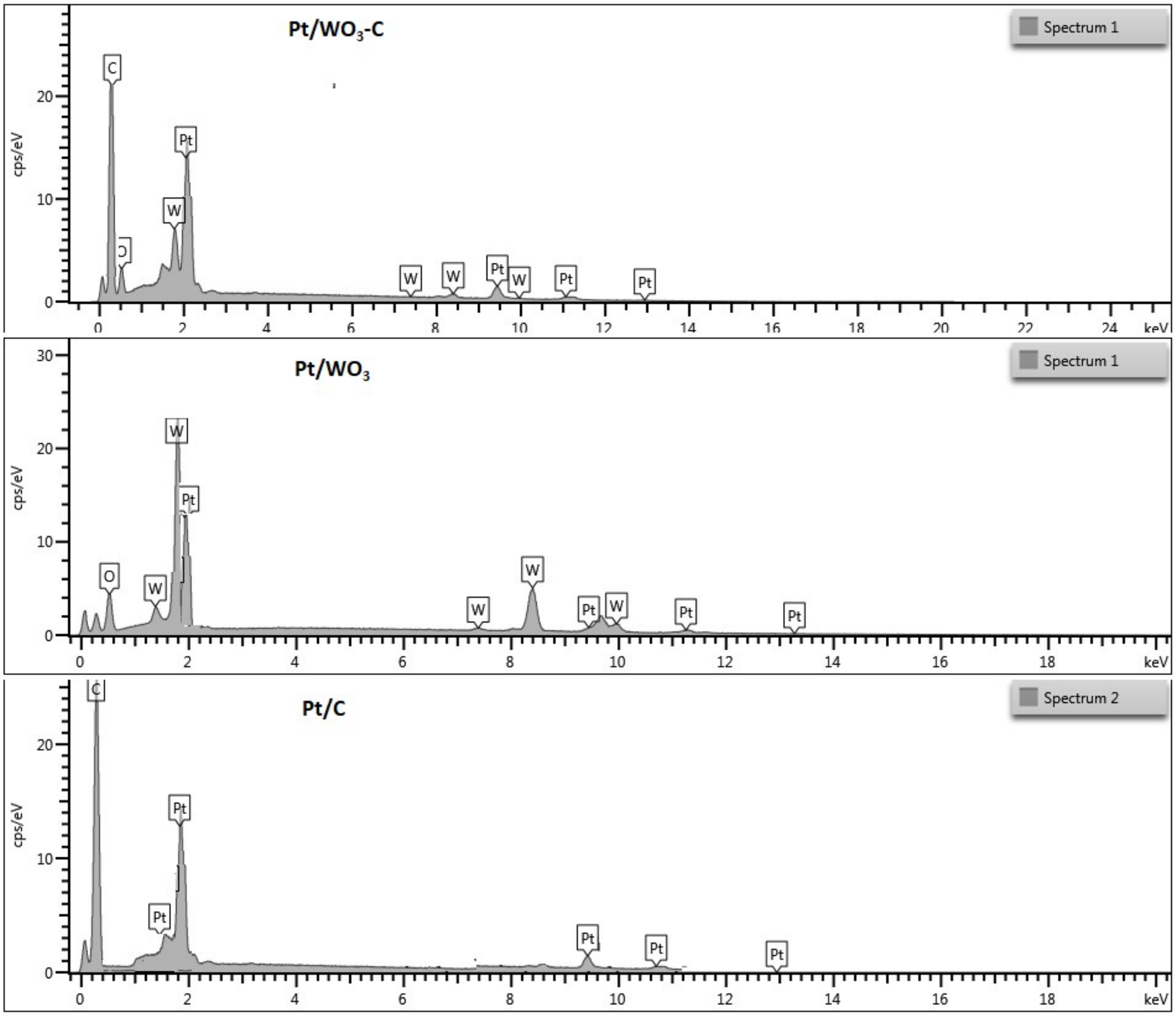

Figure S3: EDX spectra of Pt/WO3-C, Pt/WO3 and Pt/C

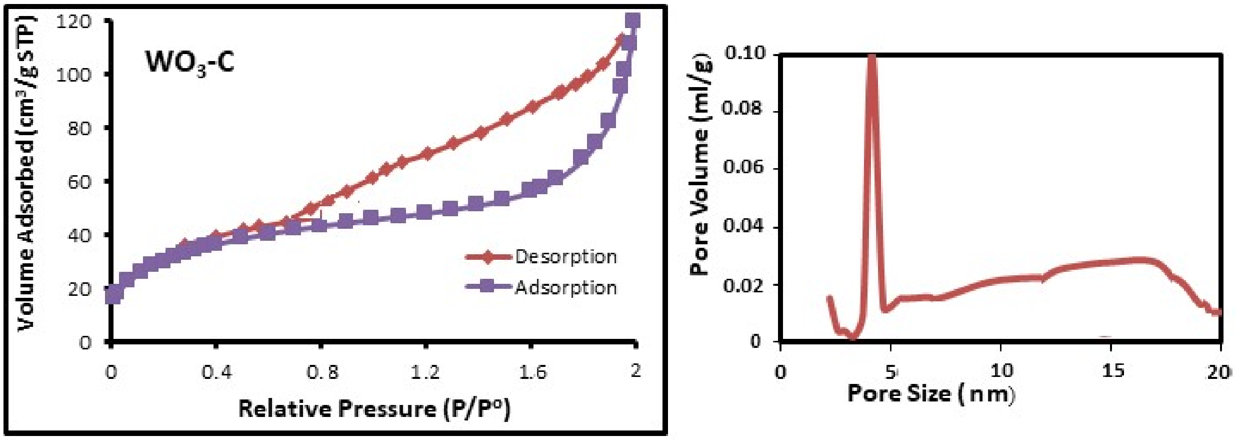

Figure S4: N_2 adsorption desorption isotherm and (a) pore size distribution curve of WO_3-C

Table S2: Compositional analysis of catalysts from EDX results

Catalysts	C %	Pt %	W%	O %	Total
Pt/WO_3-C	78.9	9.28	7.6	4.2	100
Pt/WO_3	…..	9.31	79	21.0	100
Pt/C	86.0	9.16	…..	4.64	100

Table S3: Electrochemical surface area, $Q_{Pt-H/C}$ and Roughness factor from CVs in 1M H_2SO_4 on Pt/WO3-C, Pt/WO3and Pt/C catalysts

Catalysts	Mass of Pt/mg	Q_{pt-H}/ C	$S_{ESA}/m^2 \cdot g^{-1}$	RSA (cm^2)	Roughness Factor
Pt/C	0.16	4460	132	21.24	27.10
Pt/WO_3	0.16	15019	447	71.52	91.10
Pt/WO_3-C	0.16	16750	498	79.76	101.60

Table S4: Activity parameters evaluated from CVs in 1M CH_3OH + 1M H_2SO_4 on various Pt/WO3-C, Pt/WO3and Pt/C catalysts.

Catalysts	Peak potential Ep/V	Peak Current Ip/(mA)	Specific activity I_s/mA·cm^{-2}	Mass activity I_m/mA·mg^{-1} Pt
Pt/C	0.670	4.87	6.20	30.4
Pt/WO_3	0.695	12.07	15.4	75.4
Pt/WO_3-C	0.736	28.75	36.6	180

Table S5: Polarization data evaluated from Tafel plots in 1M CH_3OH + 1M H_2SO_4

Catalysts	Tafel's slope"b" /(V decade $^{-1}$)	αn_α	Intercept of E vs Log ί	$ί^O$ mA·cm^{-2}
Pt/C	0.178	0.331	1.049	5.65
Pt/WO_3	0.321	0.184	1.156	33.8
Pt/WO_3-C	0.330	0.179	1.176	34.4

Table S6: Activity parameters evaluated from CVs in 1M CH_3OH + 1M KOH on Pt/WO_3-C, Pt/WO_3, Pt/C catalysts

Catalysts	Peak potential E_p/V	Peak Current I_p/(mA)	Specific activity j/mA·cm^{-2}	Mass activity mA/g Pt
Pt/C	-0.153	26.37	33.592	165
Pt/WO_3	-0.136	27.61	35.172	172
Pt/WO_3-C	-0.126	43.0	54.777	269

Table S7: Polarization data evaluated from Tafel plots in 1M CH_3OH + 1MKOH.

Catalysts	Tafel's slope"b" /(V decade $^{-1}$)	αn_α	Intercept of E vs Log í	$í^O$ mA·cm^{-2}
Pt/C	0.2107	0.2806	0.0402	41.50
Pt/WO_3	0.3139	0.1885	0.2180	51.26
Pt/WO_3-C	0.2859	0.2068	0.1211	60.13

Table S8: Rate constants of 1MCH_3OH in basic medium.

Catalysts	Peak Current Ip/(mA)	Rate Constant k_{het}/cm.s^{-1}* 10^{-5}
Pt/C	26.37	15.7
Pt/WO_3	27.61	16.1
Pt/WO_3-C	43.0	22.4

Table S9: BET specific surface area and pore volume and pore diameter of WO_3-C, WO_3 and C

Catalyst Support	BET surface(m^2g^{-1})	Total pore volume(cm^3g^{-1})	Average pore diameter(nm)
WO_3-C	117.75	0.10	4.86 (This work)
WO_3	76.05	0.189	11.6[1, 2]
C	235	0.67	5.28[3]

References

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[3] T. Maiyalagan, T.O. Alaje, K. Scott, Highly stable Pt–Ru nanoparticles supported on three-dimensional cubic ordered mesoporous carbon (Pt–Ru/CMK-8) as promising electrocatalysts for methanol oxidation, The Journal of Physical Chemistry C, 116 (2012) 2630-2638.