

# Interfacial ion diffusion and rapid charge transfer kinetics of hydrothermally synthesized heterostructure $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3/\text{MXene}$ composite for next generation pseudocapacitors

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## 1. Material Characterization

The structural characterization of the synthesized materials ( $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3$  and  $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3/\text{MXene}$ ) was conducted using an advanced X-ray diffractometer (Bruker-D8) equipped with a  $\text{CuK}\alpha$  radiation source ( $\lambda = 1.5407 \text{ \AA}$ ), operating at 45 kV and 30 mA. Data

were collected over a  $2\theta$  range of  $0^\circ$ – $100^\circ$  with a scanning rate of  $1.5^\circ/\text{min}$ . The surface morphology of the synthesized materials was examined using a scanning electron microscope (SEM, MAIA3 XMH, Model 2016). X-ray photoelectron spectroscopy (XPS) was carried out using a PHI Quantera SXM (ULVAC-PH) with mono-chromated  $\text{AlK}\alpha$  (1486.7eV) radiation under a pressure of  $4 \times 10^{-8}$  Pa. Electrochemical performance was evaluated via cyclic voltammetry (CV), galvanostatic charge-discharge (GCD), and electrochemical impedance spectroscopy (EIS) using a three-electrode setup on a Metrohm Autolab 302-N electrochemical workstation. All electrochemical measurements were carried out at room temperature in a 3M KOH aqueous electrolyte, with instrument control and data acquisition managed through Nova 2.1 software.

**Table S1** Specific capacitance of  $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3$  and  $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3/\text{MXene}$  at different scan rate

Sr.No.	Scan rate ( $\text{mVs}^{-1}$ )	Potential Window ( $\Delta\text{V}$ )	Specific Capacitance of $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3$ ( $\text{Fg}^{-1}$ )	Specific Capacitance of $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3/\text{MXene}$ ( $\text{Fg}^{-1}$ )
1	5	0.6	1202.58	1815.91
2	10	0.6	870.3	1305.64
3	20	0.6	627.95	891.46
4	30	0.6	511.506	702.52
5	40	0.6	435.51	572.59
6	50	0.6	379.742	514.6
7	80	0.6	302.44	389.09
8	100	0.6	267.08	368.705

**Table S2** Specific capacitance of  $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3/\text{MXene}$  calculated from GCD

Sr. No	Current density (A/g)	Potential Window ( $\Delta V$ )	Specific Capacity of $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3/\text{MXene}$ ( $\text{Fg}^{-1}$ )
1	1	0.6	988.69
2	2	0.6	533.34
3	3	0.6	442.10
4	5	0.6	393.38
5	7	0.6	274.18
6	10	0.6	108.9

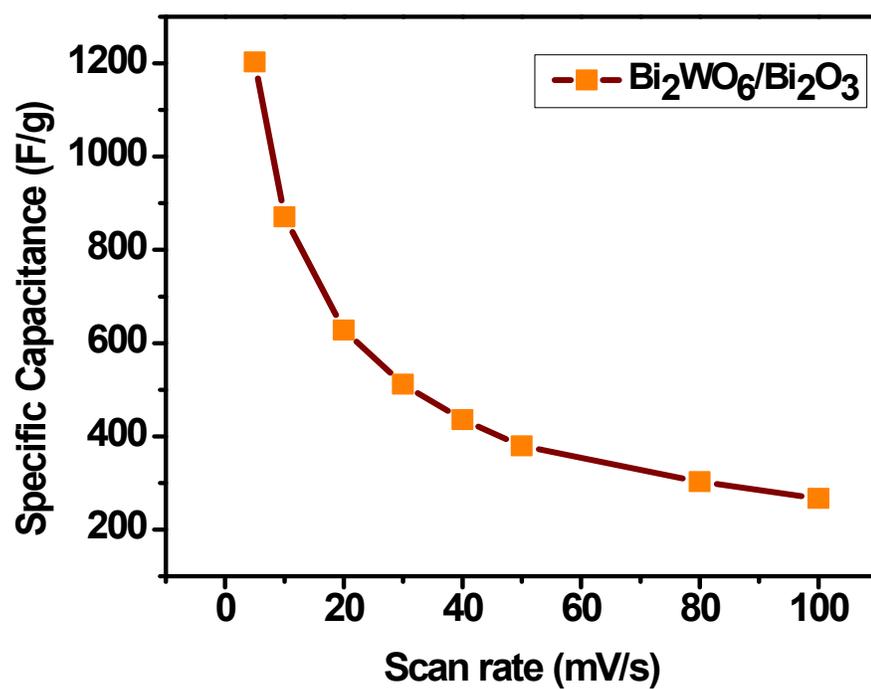


Figure S1 depicts decrease in specific capacitance of  $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3$

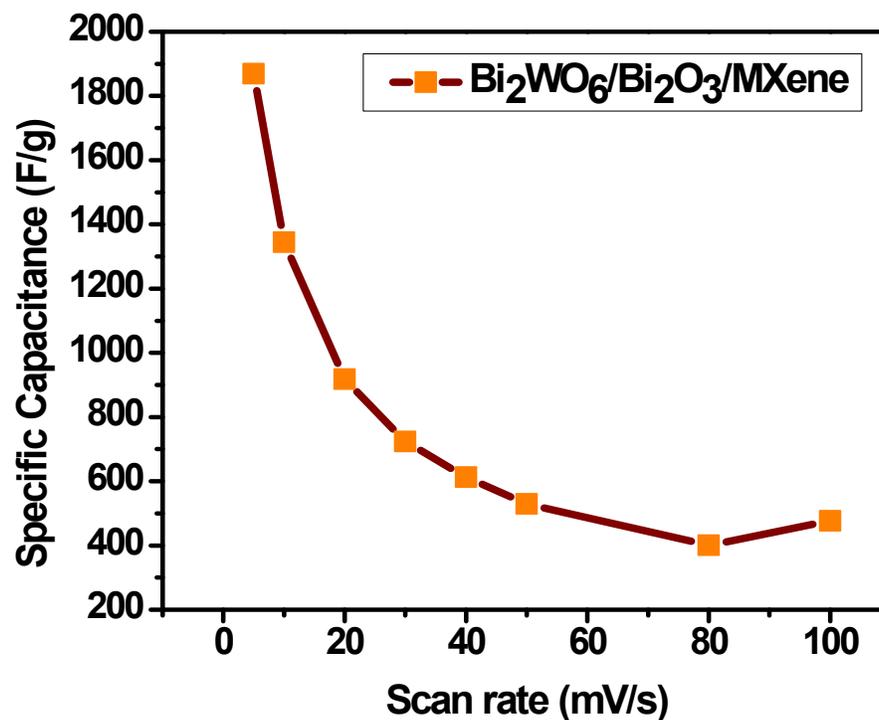


Figure S2 depicts decrease in specific capacitance of  $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3/\text{MXene}$

Table S3 depict parameters of  $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3$  and  $\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3/\text{MXene}$  calculated from BET analysis.

Sr.No	Composition	Surface area ( $\text{m}^2/\text{g}$ )	Pore volume ( $\text{cm}^3/\text{g}$ )	Pore size (nm)
1	$\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3$	55.96	0.082	1.81
2	$\text{Bi}_2\text{WO}_6/\text{Bi}_2\text{O}_3/\text{MXene}$	82.42	0.119	1.89