Supporting Information

Nb_2CT_x MXene Integrated $DyMn_2O_5$ Composites: Tailored Particle Size and Enhanced Capacitance for High-Performance Pseudocapacitor

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1. Material Characterization

The structural characterization of the synthesized materials ($DyMn_2O_5/Dy_2O_3$ and $DyMn_2O_5/Dy_2O_3$/MXene) was conducted using an advanced X-ray diffractometer (Bruker-D8) equipped with a CuKα radiation source (λ = 1.5407 Å), operating at 40 kV and 35 mA. Data were collected over a 2θ range of 20°–80° with a scanning rate of 1.5°/min. Fourier Transform Infrared (FT-IR) spectroscopy was performed using a Thermo Scientific Nicolet 6700 spectrometer within the 400–4000 cm^{-1} range (4 cm^{-1} resolution, 256 scans) to qualitatively analyze the chemical composition and identify functional groups present in the composites. The

surface morphology of the synthesized materials was examined using a scanning electron microscope (SEM, MAIA3 XMH, Model 2016). 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.

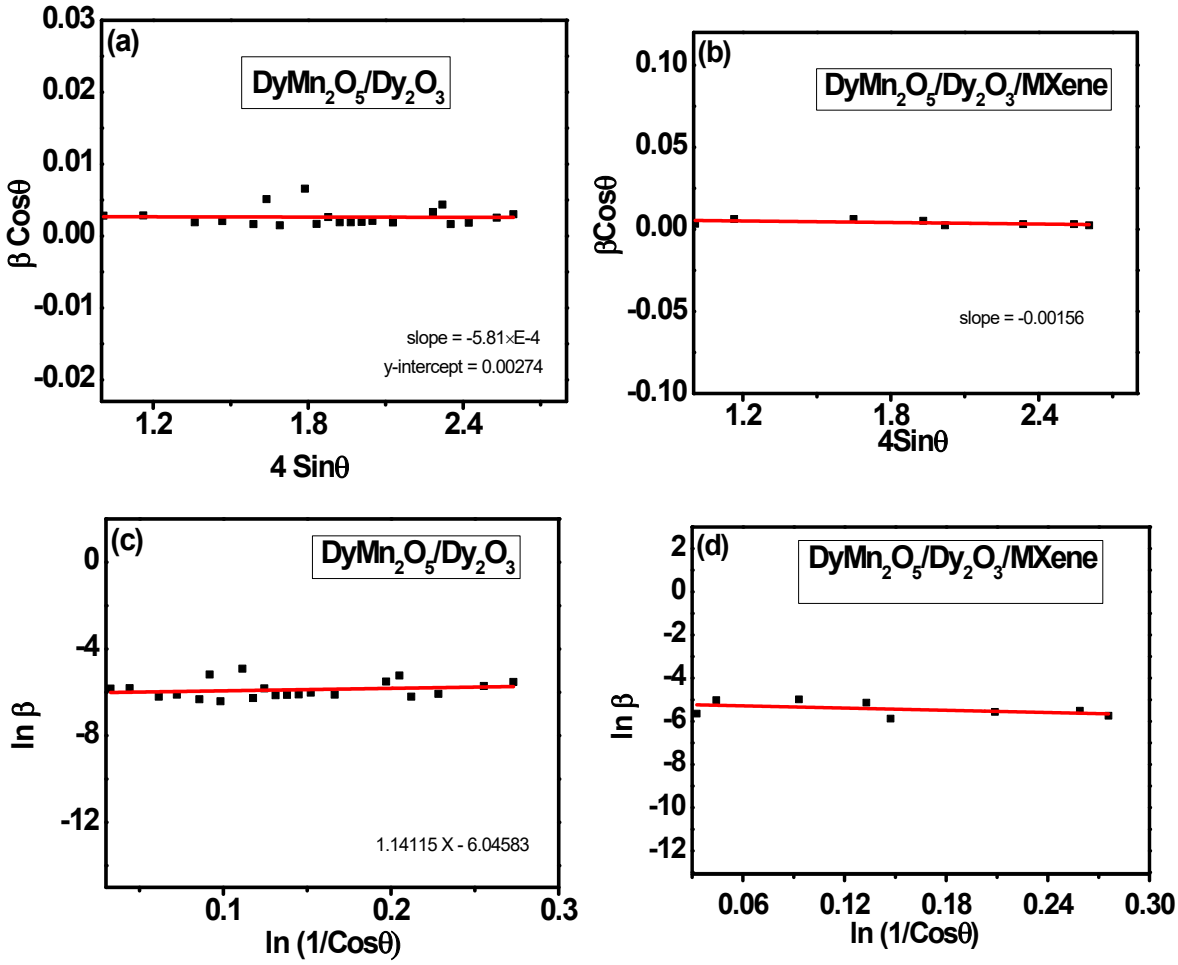

Figure S1.(a) W-H plot for $DyMn_2O_5$ / Dy_2O_3 (b) W-H plot for composite $DyMn_2O_5$ / Dy_2O_3 /MXene (c) Modified W-H plot for base $DyMn_2O_5$ / Dy_2O_3 (d) Modified W-H plot for composite $DyMn_2O_5$ / Dy_2O_3 /MXene

Table S1 Specific capacitance at different scan rate

Sr.No.	Scan rate (mVs^{-1})	Potential Window (△V)	Specific Capacitance of MXene	Specific Capacitance of $DyMn_2O_5/Dy_2O_3$ (Fg^{-1})	Specific Capacitance of $DyMn_2O_5/Dy_2O_3$/MXene (Fg^{-1})
1	10	0.6	105.90	703.97	863.01
2	20	0.6	61.13	394.5	629.3
3	30	0.6	50.24	285.9	530.2
4	40	0.6	44.30	241.0	413.9
5	50	0.6	39.10	208.6	368.0
6	100	0.6	23.92	130.6	213.9

Table S2 Specific capacity calculated from GCD

Sr. No	Current density (A/g)	Potential Window (△V)	Specific Capacityof $DyMn_2O_5/Dy_2O_3$/MXene (Cg^{-1})
1	1	0.5	362.92
2	2	0.5	293.78
3	3	0.5	242.43
4	4	0.5	223.44
5	5	0.5	189.55
6	10	0.5	99.21
7	20	0.5	96.40