

Supporting Information

Rational Construction of Spinel Cobaltite/MXene Composites towards Superior Interfacial Charge Dynamics for Advanced Pseudocapacitors

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1. Material Characterization

The structural characterization of the synthesized materials (Nb_2CT_x (MXene), MgCo_2O_4 and $\text{MgCo}_2\text{O}_4/\text{MXene}$) 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 40 kV and 35 mA. Data were collected over a 2θ range of 20° – 80° with a scanning rate of $1.5^\circ/\text{min}$. 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.

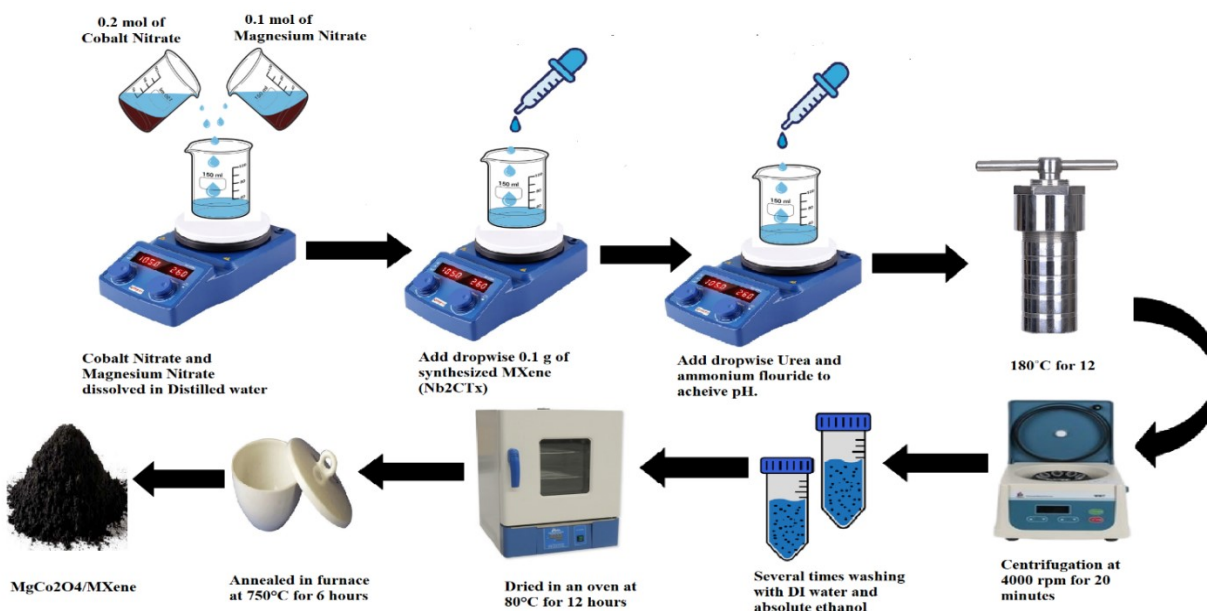


Figure S1. Hydrothermal synthesis of nanocomposite MgCo₂O₄/MXene

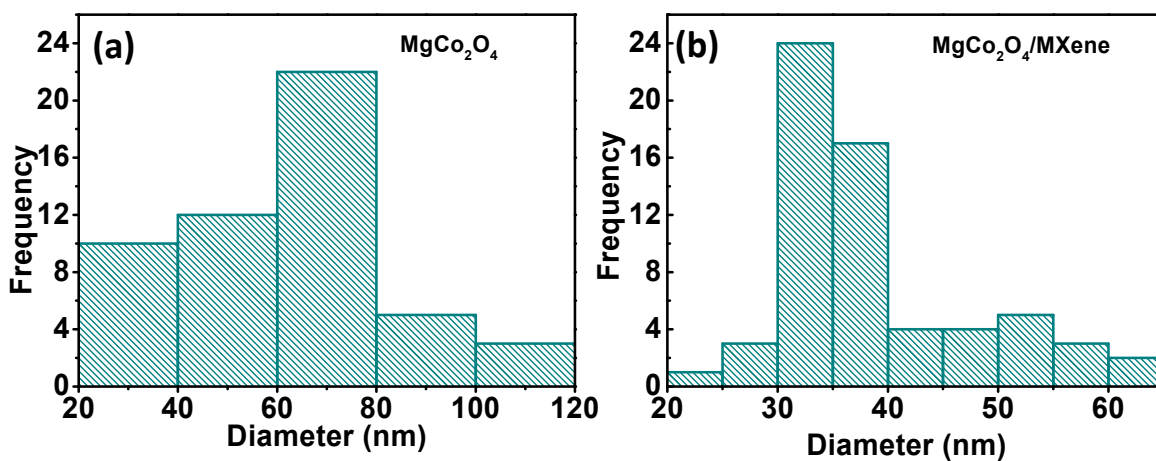


Figure S2. Histogram representing average diameter of nanocomposites MgCo₂O₄ and MgCo₂O₄/MXene

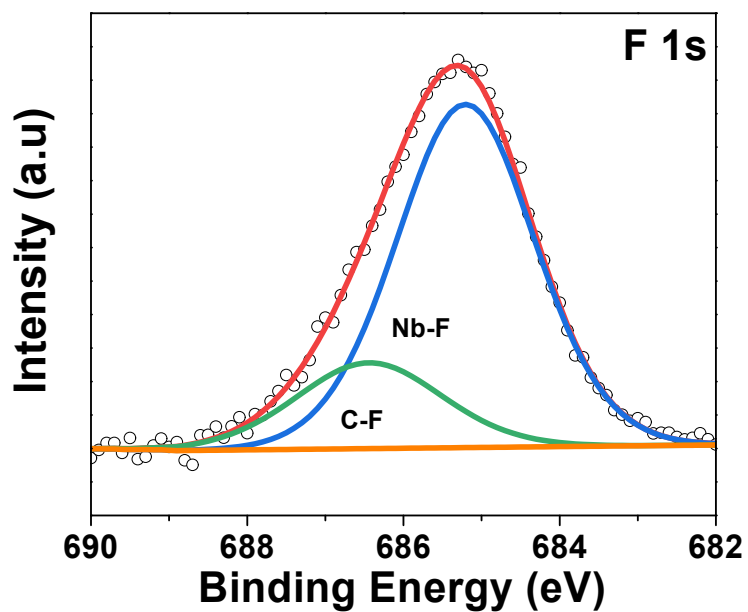


Figure S3. High resolution spectrum of F 1s from MgCo₂O₄/MXene composites

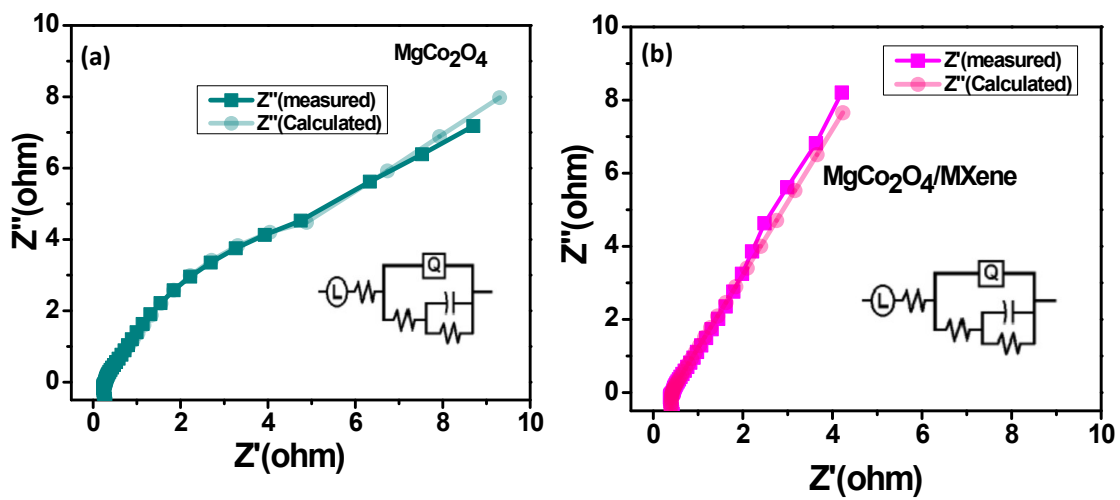


Figure S4. (a) & (b) Fitted plot of $MgCo_2O_4$ and $MgCo_2O_4/MXene$ using Zsimpwim software

Table S1 Specific capacitance calculated from GCD of MgCo₂O₄/MXene

Sr. No	Current density (F/g)	Potential Window (ΔV)	Discharge time (dt)	Specific Capacitance of MgCo₂O₄/MXene (Fg⁻¹)
1	1	0.6	595.78	1257.75
2	2	0.6	312.06	1040.2
3	3	0.6	159.96	879.78
4	5	0.6	90.95	803.39
5	7	0.6	60.29	703.3
6	10	0.6	40.5	675