Supporting Information

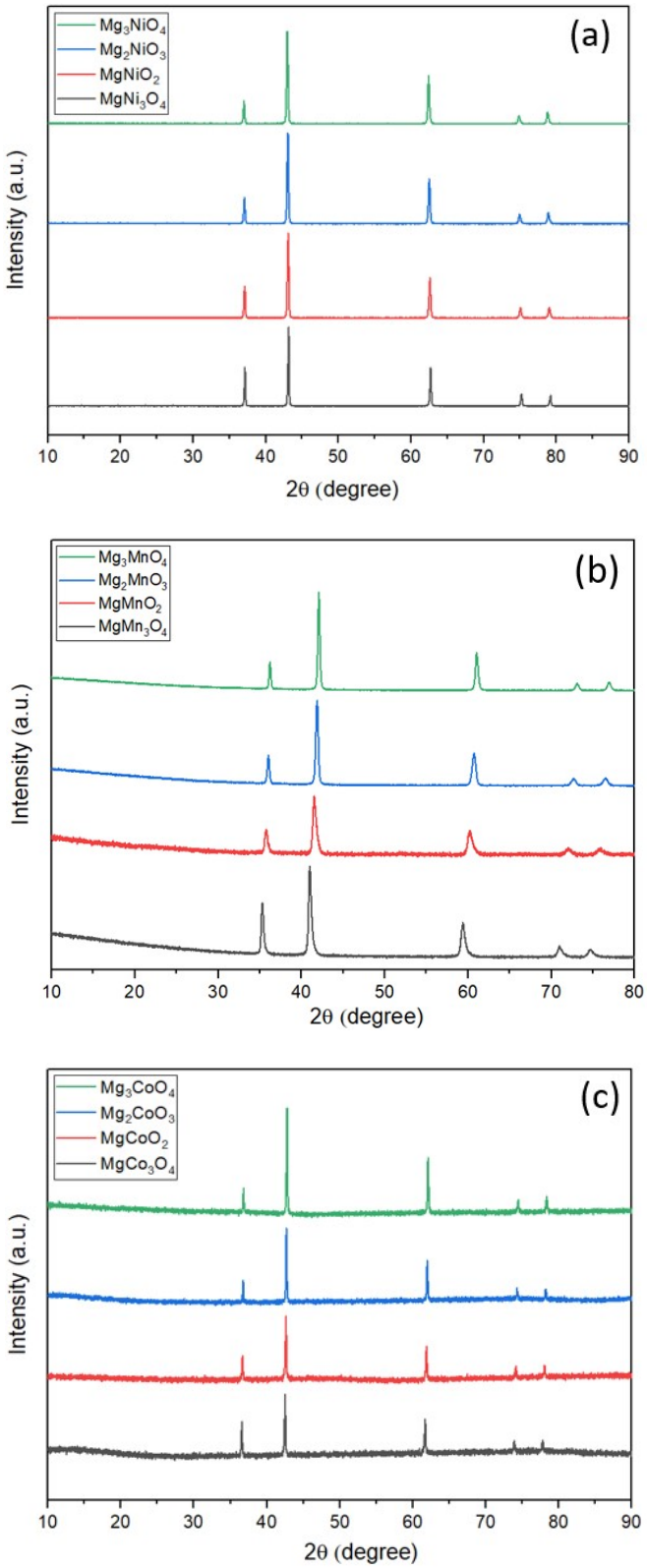

Fig. S1. Monochromatic PXRD data for as-synthesised (a) $Mg_xNi_{1-x}O$, (b) $Mg_xMn_{1-x}O$, and (c) $Mg_xCo_{1-x}O$ samples via solid-state method.

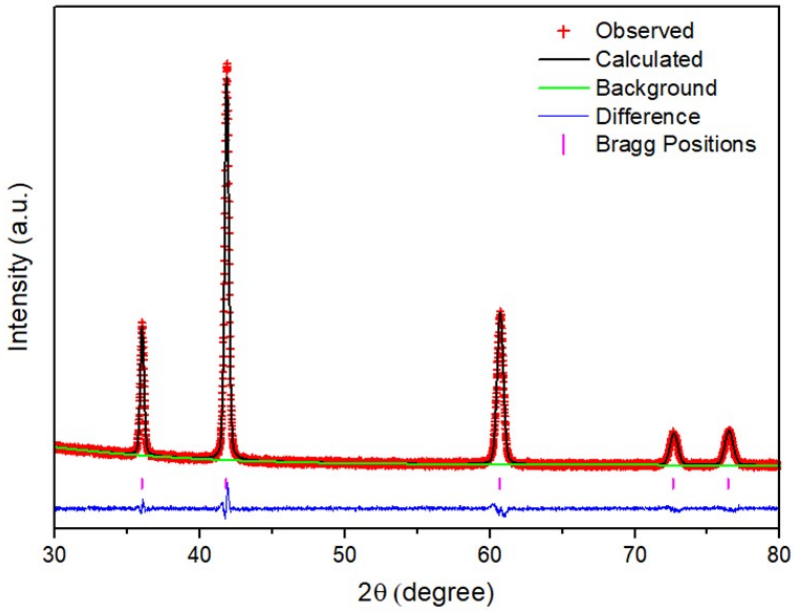

Fig. S2. Fitted XRD data for DRS Mg_2MnO_3 (before ball-milling) refined with Fm-3m space group.

Atom	Wyckoff Positions	x	y	z	Occupancy	U_{iso}
Mg	a	0	0	0	0.66	0.00977(4)
Mn	a	0	0	0	0.34	0.01267(4)
O	b	0.5	0.5	0.5	1	0.01479(3)
a=4.3054(3) Å, Space Group: Fm-3m, Domain size (μm)=1.0001, Microstrain=1081.2						
RF=1.057%, reduced χ**2=1.24						

Table S1. Table of XRD Rietveld refinement parameters for Mg_2MnO_3 (before ball-milling).

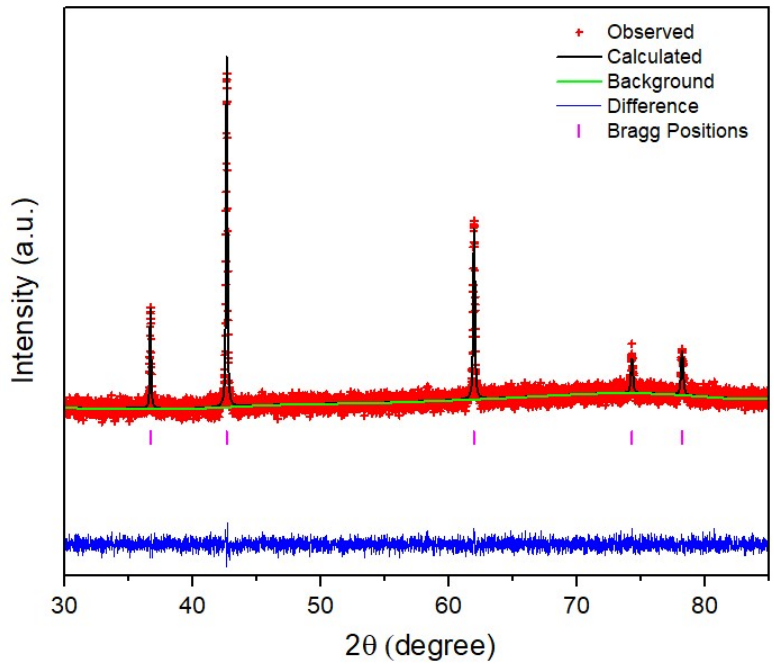

Fig. S3. Fitted XRD data for DRS Mg_2CoO_3 refined with Fm-3m space group.

Atom	Wyckoff Positions	x	y	z	Occupancy	U_{iso}
Mg	a	0	0	0	0.66	0.00122(1)
Co	a	0	0	0	0.34	0.00478(4)
O	b	0.5	0.5	0.5	1	0.00229(1)
a=4.2273(4) Å, Space Group: Fm-3m						
RF=24.231%, reduced χ**2=0.86						

Table S2. Table of XRD Rietveld refinement parameters for Mg_2CoO_3. It should be noted that the PXRD data for Co-containing compounds is noisy due to the high background fluorescence from Co.

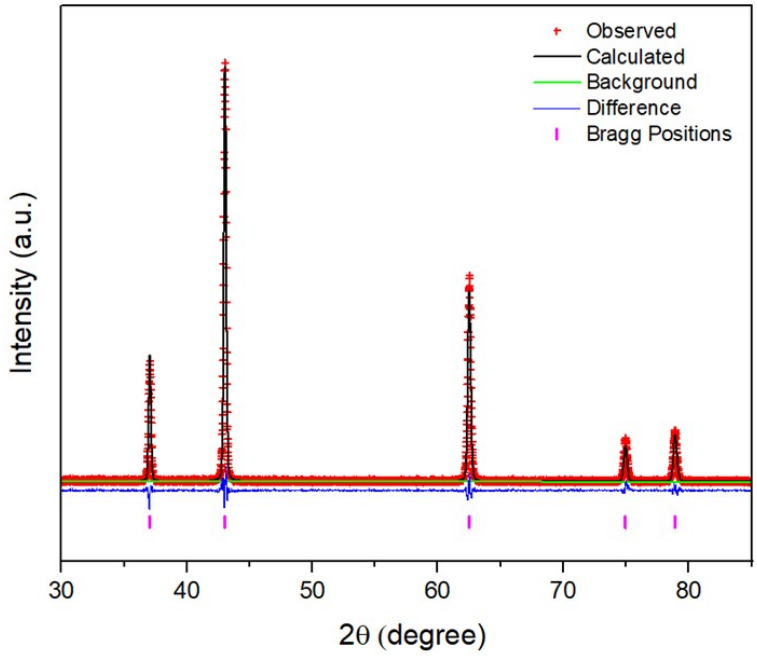

Fig. S4. Fitted XRD data for DRS Mg_2NiO_3 refined with Fm-3m space group.

Atom	Wyckoff Positions	x	y	z	Occupancy	U_{iso}
Mg	a	0	0	0	0.66	0.02085(6)
Ni	a	0	0	0	0.34	0.00070(6)
O	b	0.5	0.5	0.5	1	0.00551(1)
a=4.2041(7) Å, Space Group: Fm-3m						
RF=4.310%, reduced χ**2=1.00						

Table S3. Table of XRD Rietveld refinement parameters for Mg_2NiO_3.

Atom	Wycoff	x	y	z	Occupancy
Mg	a	0	0	0	0.66
Mn	a	0	0	0	0.34
O	b	0.5	0.5	0.5	1
S.G.=Fm$\bar{3}$m, R_w=0.207, Q_{max}=24 Å, r=1-40 Å,		a=4.313 Å		α=90	

Table S4. X-ray PDF refinement parameters for Mg_2MnO_3 (without ball-milling).

Atom	Wycoff	x	y	z	Occupancy
Mg	a	0	0	0	0.66
Co	a	0	0	0	0.34
O	b	0.5	0.5	0.5	1
S.G.=Fm$\bar{3}$m, R_w=0.180, Q_{max}=24 Å, r=1-40 Å,		a=4.230 Å		α=90	

Table S5. X-ray PDF refinement parameters for Mg_2CoO_3.

Atom	Wycoff	x	y	z	Occupancy
Mg	a	0	0	0	0.66
Ni	a	0	0	0	0.34
O	b	0.5	0.5	0.5	1
S.G.=Fm$\bar{3}$m, R_w=0.191, Q_{max}=24 Å, r=1-40 Å,		a=4.196 Å		α=90	

Table S6. X-ray PDF refinement parameters for Mg_2NiO_3.

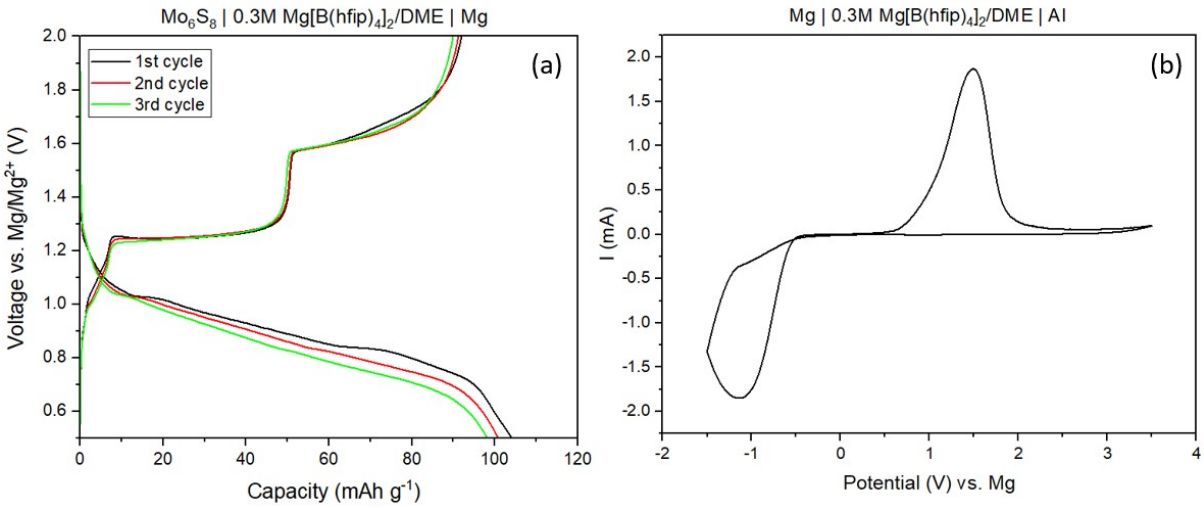

Fig. S5. (a). Galvanostatic discharge/charge profile of a Mo_6S_8||Mg cell at 60°C using the 0.3 M $Mg[B(hfip)_4]_2$ in DME electrolyte, which shows comparable capacity to reported results.[26,32] **(b) Cyclic voltammograms** using Al as the working electrode and Mg as the reference at a scan rate of 25 mV s^{-1}, and the profile reveals the 0.3 M $Mg[B(hfip)_4]_2$/DME electrolyte is stable to at least 3.5 V vs. Mg in standard coin cells.

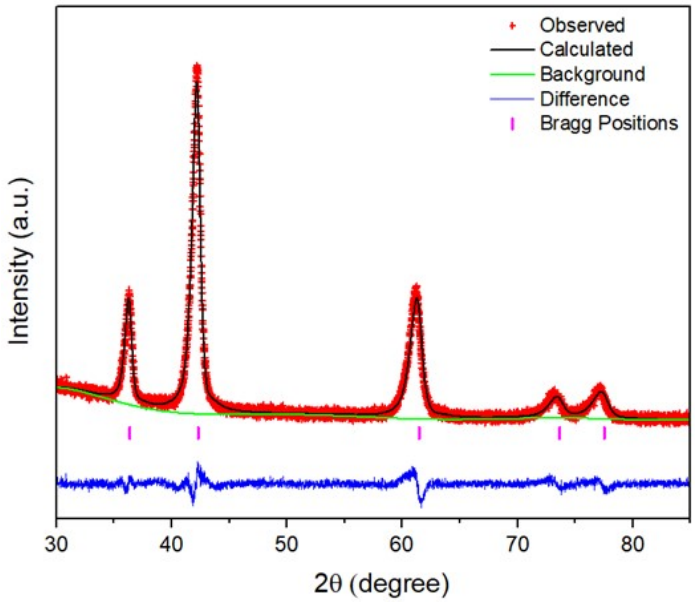

Fig. S6. Fitted XRD data for Mg_2MnO_3 after ball-milling at 200 rpm refined with Fm-3m space group.

Atom	Wyckoff Positions	x	y	z	Occupancy	U_{iso}
Mg	a	0	0	0	0.66	0.04190(2)
Mn	a	0	0	0	0.34	0.01434(3)
O	b	0.5	0.5	0.5	1	0.0002(0)
a=4.1970(8), Space Group: Fm-3m, Domain size (μm)=0.0389, Microstrain=2110.3						
RF=1.628%, reduced χ**2=1.58						

Table S7. Table of XRD Rietveld refinement parameters for Mg_2MnO_3 after ball-milling at 200 rpm. The domain size is noted to be much reduced compared to the sample before ball-milling, accompanied by an increased degree of strain effects.

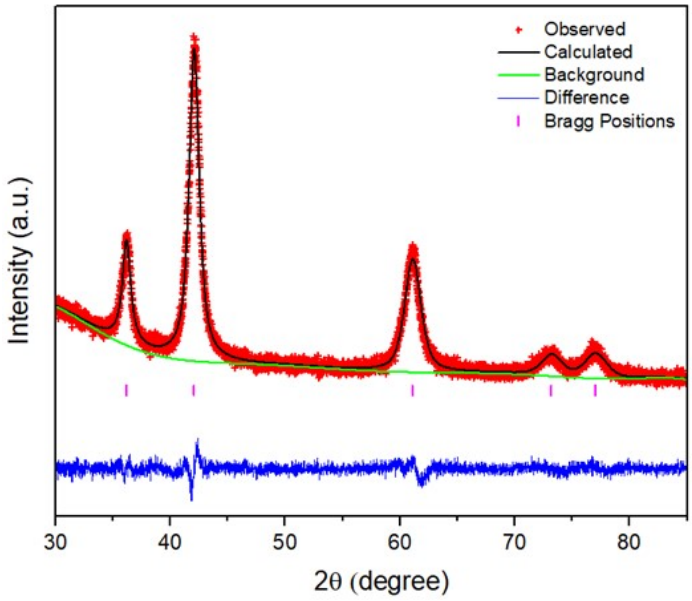

Fig. S7. Fitted XRD data for Mg_2MnO_3 after ball-milling at 300 rpm refined with Fm-3m space group.

Atom	Wyckoff Positions	x	y	z	Occupancy	U_{iso}
Mg	a	0	0	0	0.66	0.04397(2)
Mn	a	0	0	0	0.34	0.00007(9)
O	b	0.5	0.5	0.5	1	0.01789(4)
a=4.2298(8), Space Group: Fm-3m, Domain size (μm)=0.0168, Microstrain=2531.6						
RF=1.582%, reduced χ**2=1.09						

Table S8. Table of XRD Rietveld refinement parameters for Mg_2MnO_3 after ball-milling at 300 rpm. The domain size is noted to be smaller compared to that of Mg_2MnO_3 after ball-milling at 200 rpm and the sample before ball-milling, whereas the microstrain is the highest.

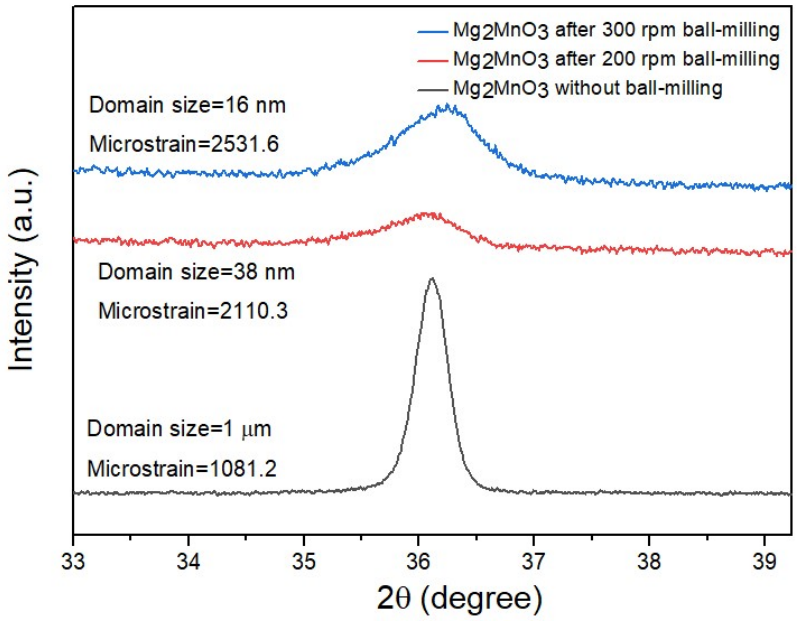

Fig. S8. PXRD patterns of Mg_2MnO_3 showing the shift in (111) peak to higher scattering angle and peak broadening after ball-milling.

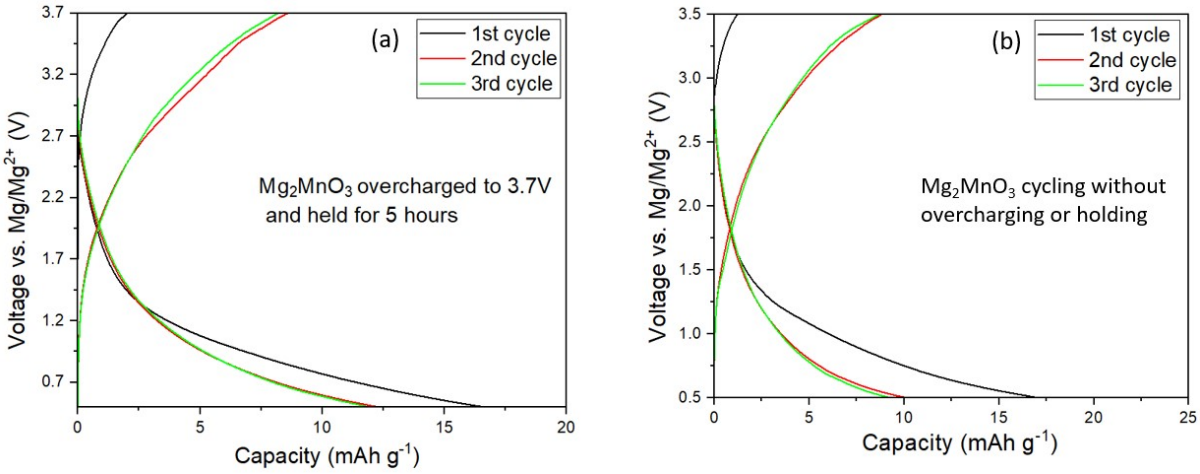

Fig. S9. Charge/discharge profiles of Mg_2MnO_3 after ball-milling at 300 rpm at 60°C and at a current density of 10 mA g^{-1}. The cathode was overcharged to 3.7V and held for 5 hours as an attempt to force it to de-magnesiate.