

Supporting Information for

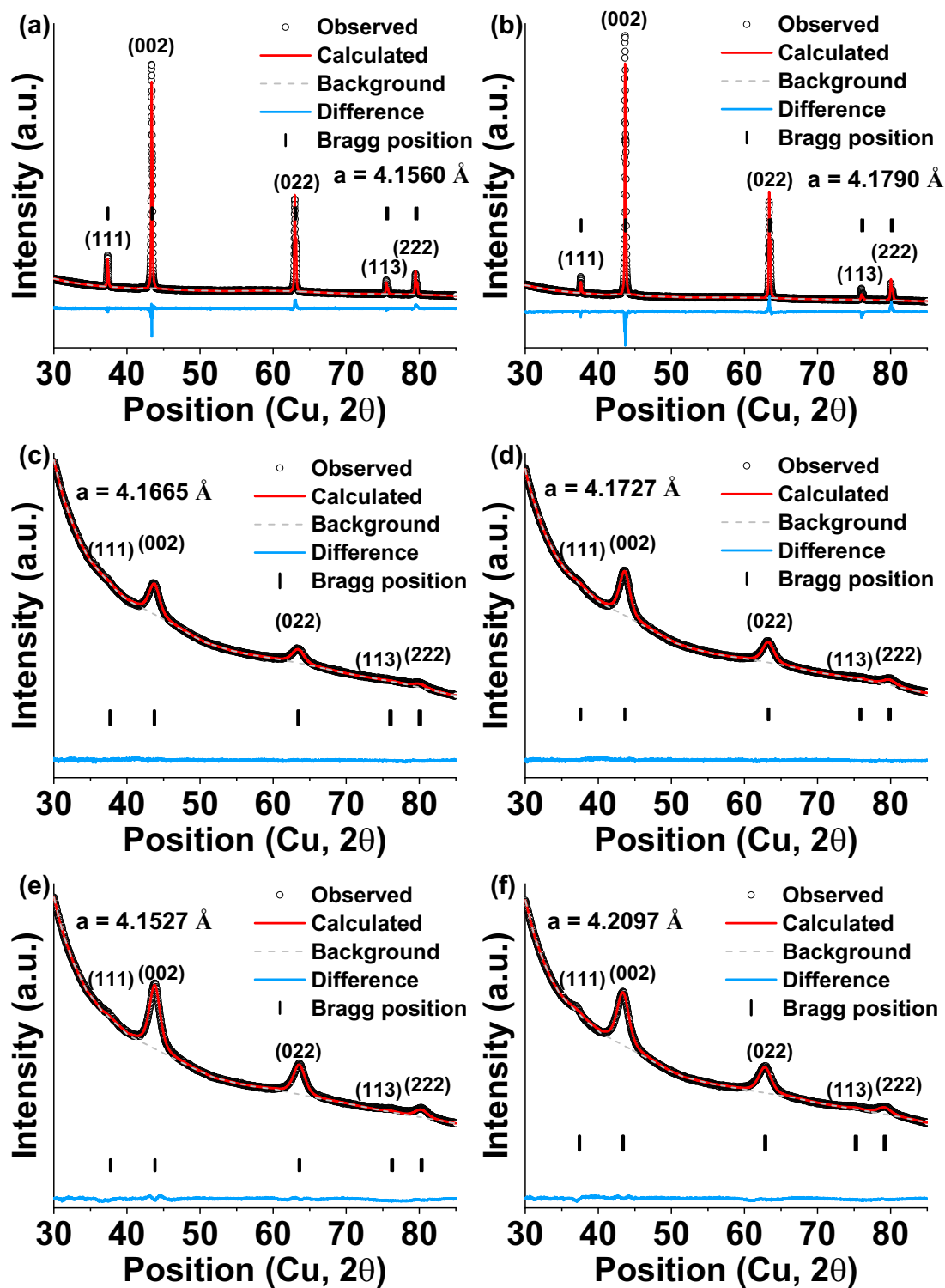
Increasing capacity in disordered rocksalt cathodes by Mg doping

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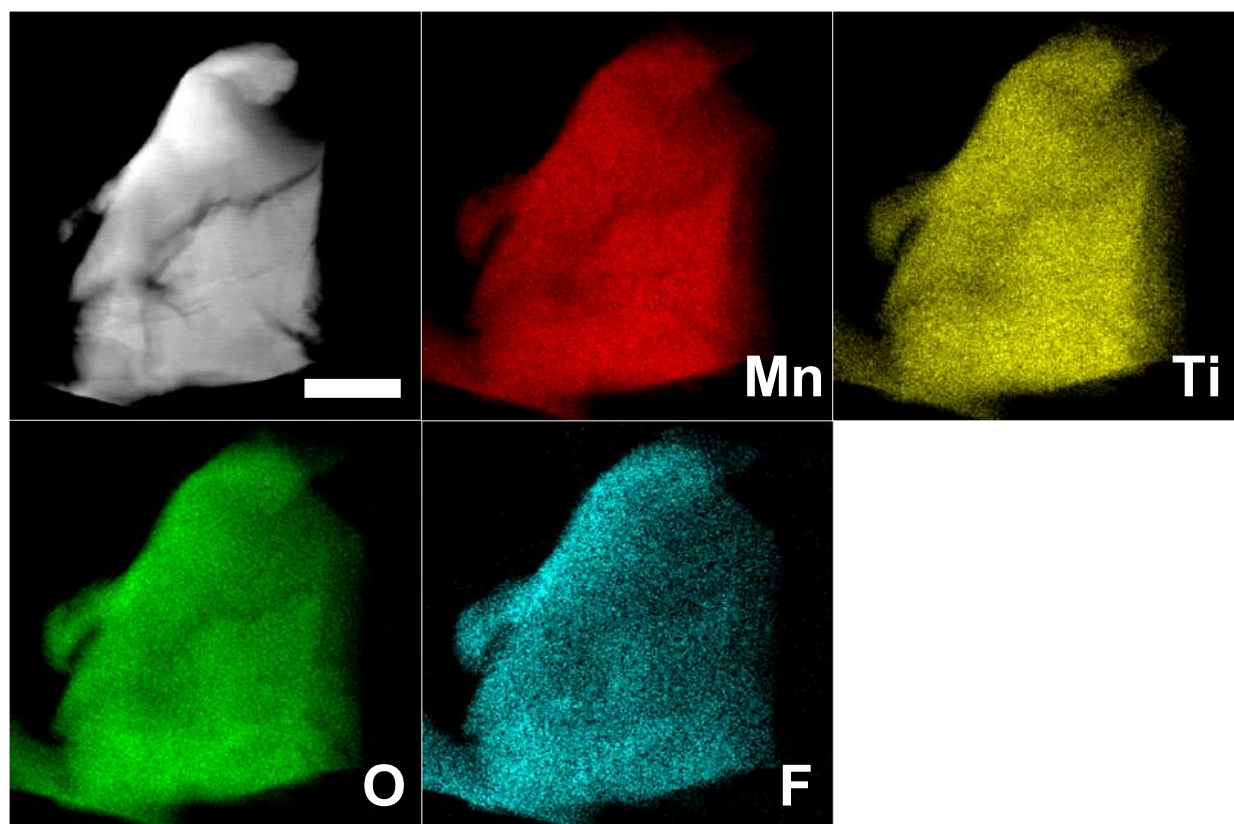
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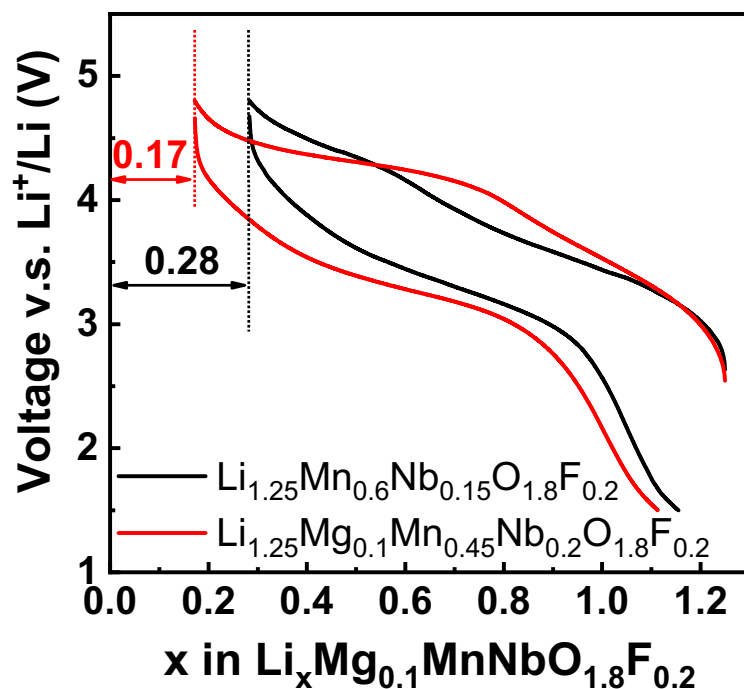
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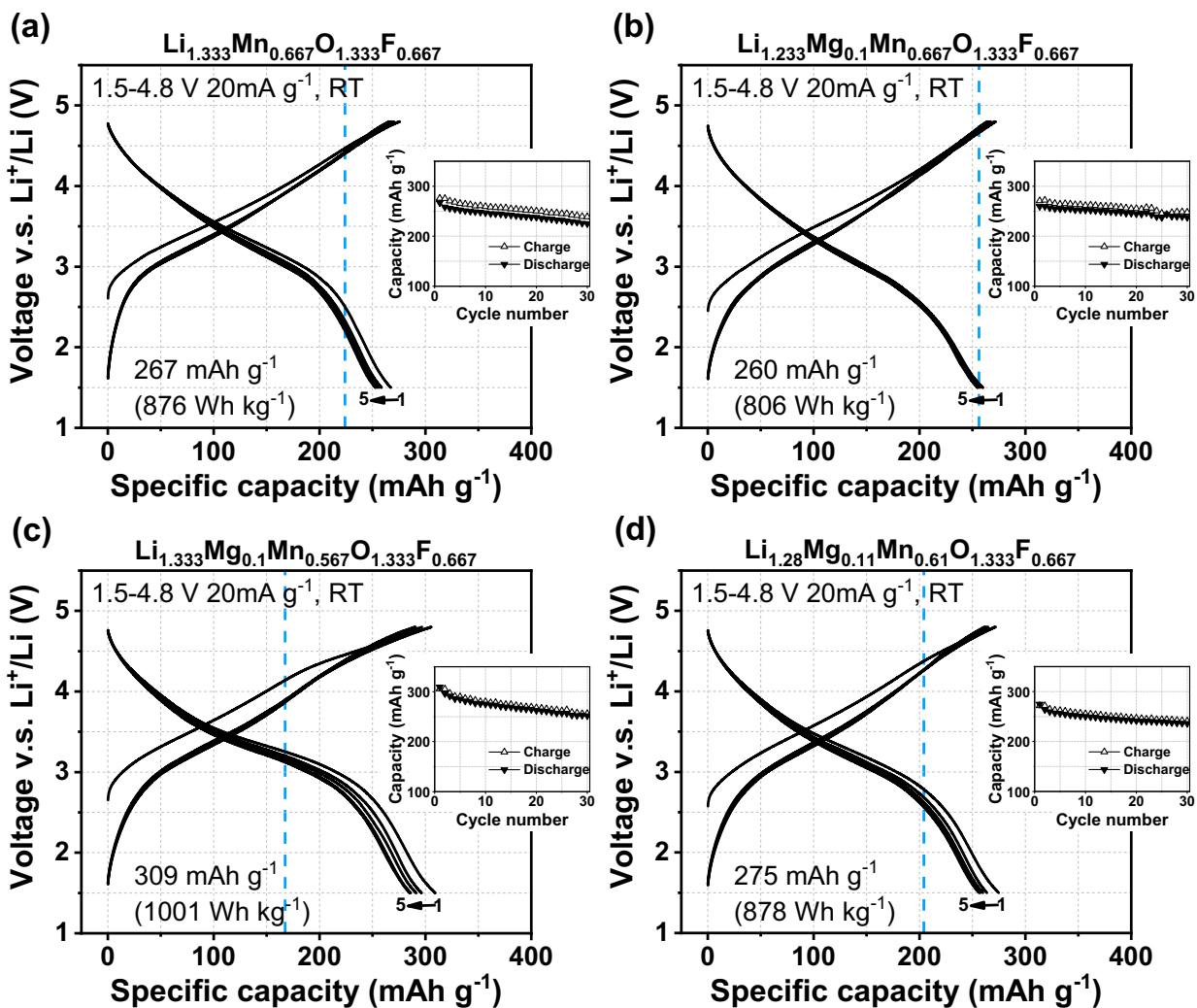
Supplementary Figure 1. XRD refinement of (a) LMTF, (b) LMMNF, (c) LMF, (d) LMMF, (e) ls-LMF, and (f) ms-LMF.



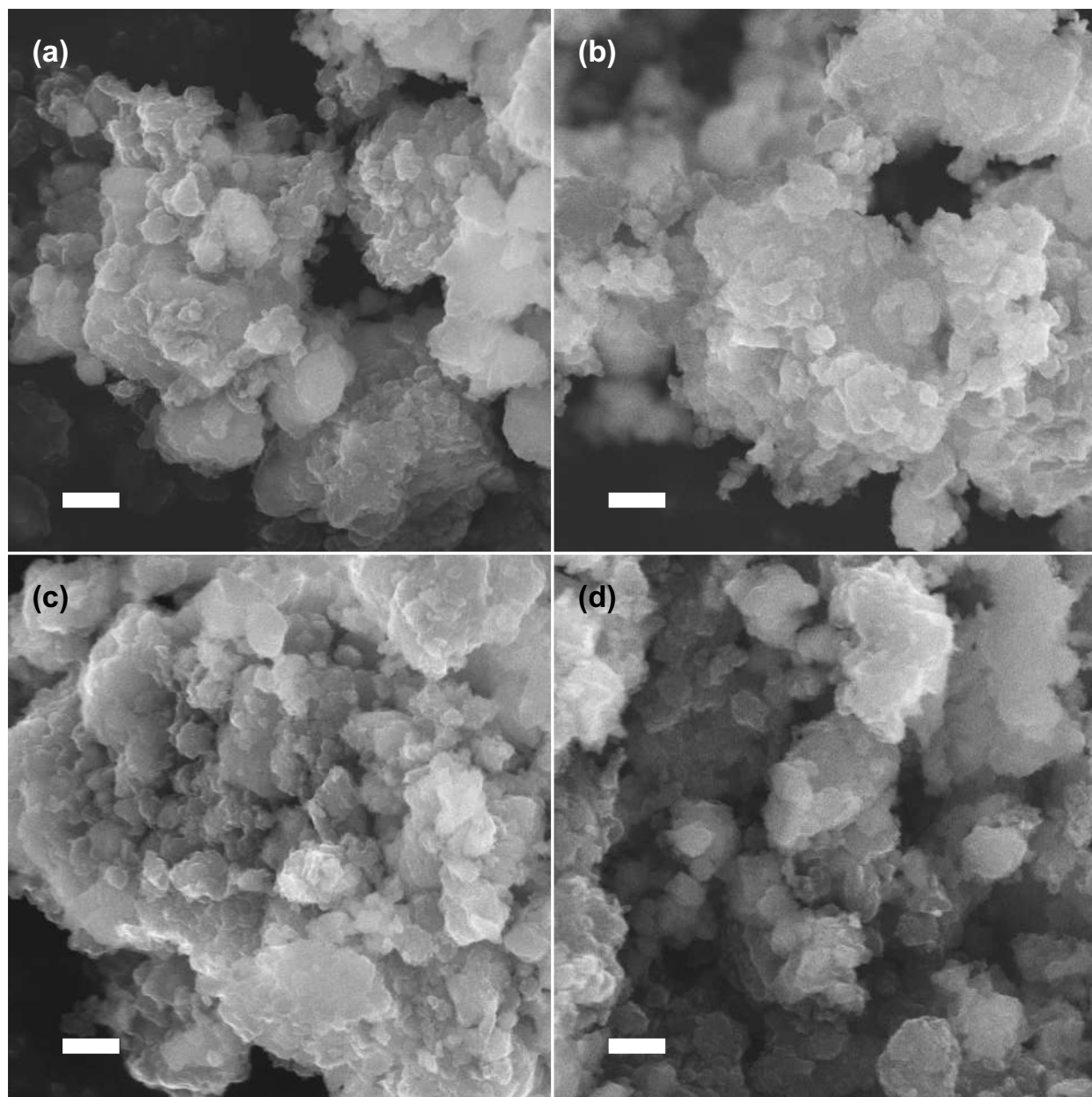
Supplementary Figure 2. TEM-EDS mapping of the element distribution in a representative particle of as-synthesized LMTF (scale bar, 300 nm)



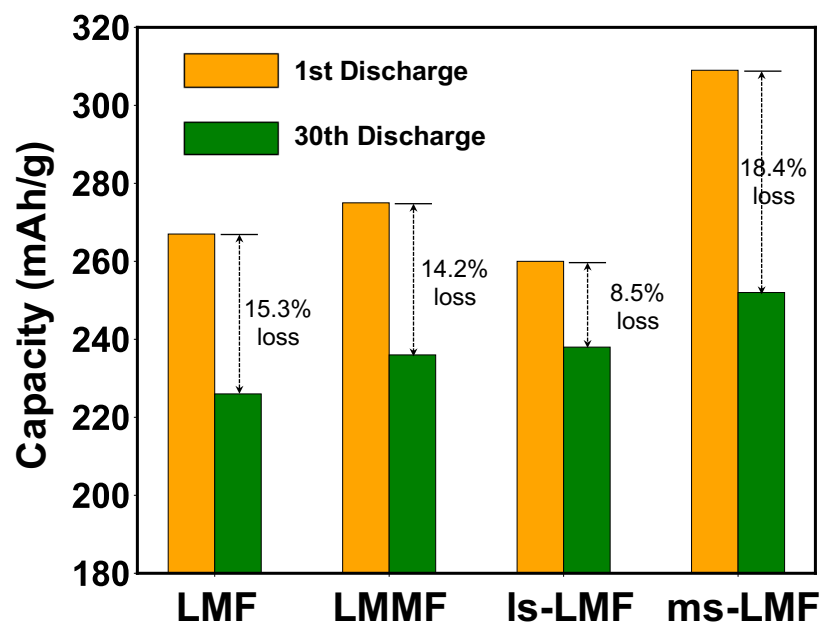
Supplementary Figure 3. Electrochemical performance of Li-(Mg)-Mn-Nb-O-F compounds. First cycle voltage profiles of $\text{Li}_{1.25}\text{Mn}_{0.6}\text{Nb}_{0.15}\text{O}_{1.8}\text{F}_{0.2}$ (black) and $\text{Li}_{1.25}\text{Mg}_{0.1}\text{Mn}_{0.45}\text{Nb}_{0.2}\text{O}_{1.8}\text{F}_{0.2}$ (red) within voltage window of 1.5 - 4.8V at 20 mA g^{-1} at room temperature. The amount of remaining Li per f.u. at top of charge is shown in the figure.



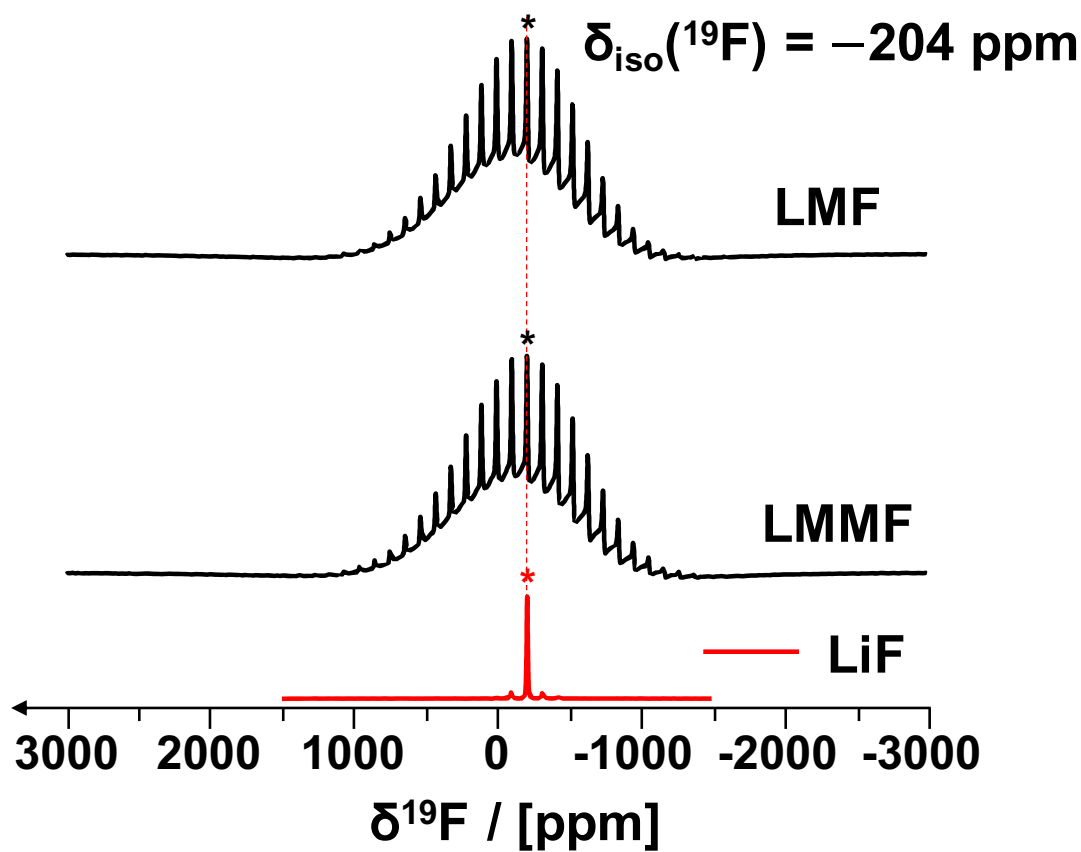
Supplementary Figure 4. Electrochemical performance of Li-(Mg)-Mn-O-F compounds. Voltage profile of the first 5 cycles and capacity retention of (a)LMF, (b) ls-LMF, (c) ms-LMF and (d) LMMF within voltage window of 1.5 - 4.8V at 20 mA g⁻¹ at room temperature. The blue dash lines indicate the theoretical Mn-redox capacity.



Supplementary Figure 5. Scanning electron microscope (SEM) images of **(a)** LMF, **(b)** LMMF, **(c)** ls-LMF and **(d)** ms-LMF that show the agglomeration of primary particles into secondary particles (scale bars, 400 nm).



Supplementary Figure 6. Cyclability comparison of LMF-based samples. The first discharge (orange) and the 30th discharge (green) capacity of LMF, LMMF, ls-LMF and ms-LMF samples are shown. The percentage of capacity loss is labeled in figure.



Supplementary Figure 7. ^{19}F spin echo MAS NMR spectra of LMF and LMMF. For comparison, ^{19}F spin echo spectra collected under similar experimental conditions ($B_0 = 7.05 \text{ T}$) on a LiF powder sample are shown in red. The isotropic shift of the sharp resonance corresponding to ^{19}F nuclei in LiF-like environments in the ^{19}F NMR spectra is denoted with an asterisk. Spinning sidebands due to fast rotation of the samples during data acquisition are observed on either side of the isotropic signals.