## **Electronic Supplementary information**

## Oxalate-assisted $Fe_2O_3$ surface functionalization of nanosized $MgMn_2O_4$ and $\alpha$ -MnO<sub>2</sub> cathodes for rechargeable magnesium batteries

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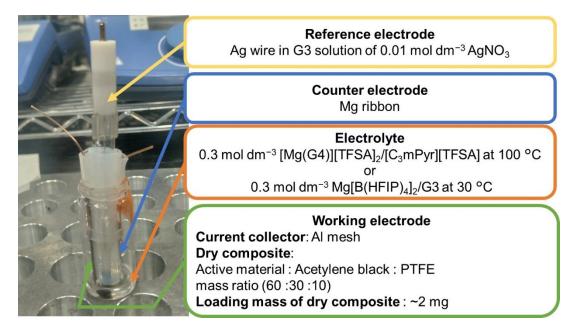


Fig. S1 Photgraph of a three-electrode cell for electrochemical measurements.

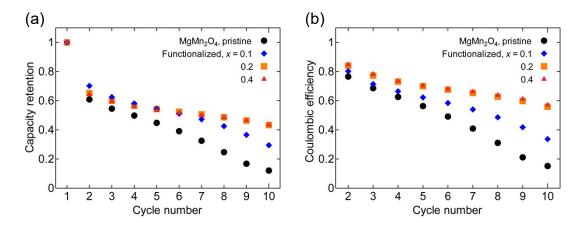


Fig. S2 (a) Capacity retention and (b) Coulombic efficiency of dry composite cathodes of pristine and Fe<sub>2</sub>O<sub>3</sub>-functionalized MgMn<sub>2</sub>O<sub>4</sub> in 0.3 mol dm<sup>-3</sup> [Mg(G4)][TFSA]<sub>2</sub>/[C<sub>3</sub>mPyr][TFSA] at 100 °C.

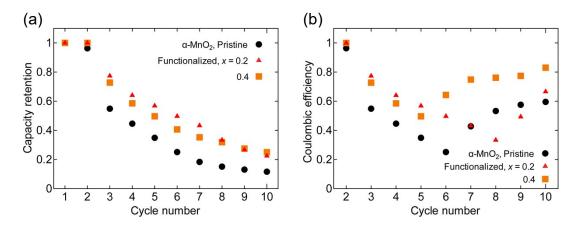


Fig. S3 (a) Capacity retention and (b) Coulombic efficiency of dry composite cathodes of pristine and Fe<sub>2</sub>O<sub>3</sub>-functionalized  $\alpha$ -MnO<sub>2</sub> in 0.3 mol dm<sup>-3</sup> [Mg(G4)][TFSA]<sub>2</sub>/[C<sub>3</sub>mPyr][TFSA] at 100 °C.

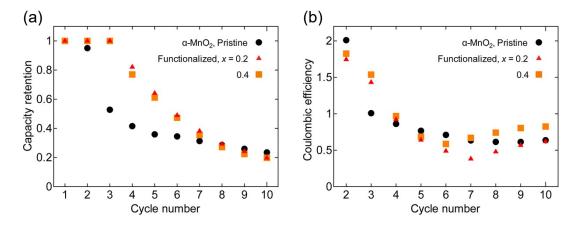


Fig. S4 (a) Capacity retention and (b) Coulombic efficiency of dry composite cathodes of pristine and Fe<sub>2</sub>O<sub>3</sub>-functionalized  $\alpha$ -MnO<sub>2</sub> with in 0.3 mol dm<sup>-3</sup> Mg[B(HFIP)<sub>4</sub>]<sub>2</sub>/G3 at 30 °C.