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Ionic Liquid Modified Graphene Nanosheets Anchoring Manganese Oxide Nanoparticles as Efficient Electrocatalysts for Zn-Air Battery

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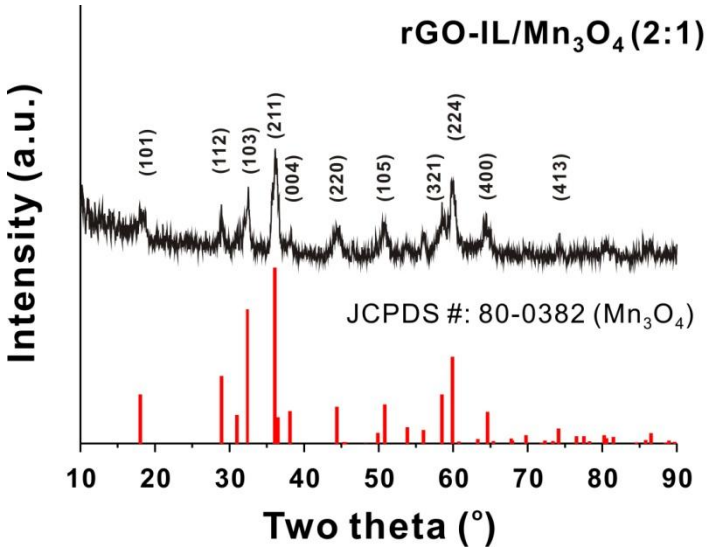

Figure S1. X-ray diffraction pattern of prepared hybrid rGO-IL/Mn_3O_4 (2:1) with the reference Mn_3O_4 diffraction pattern**.**

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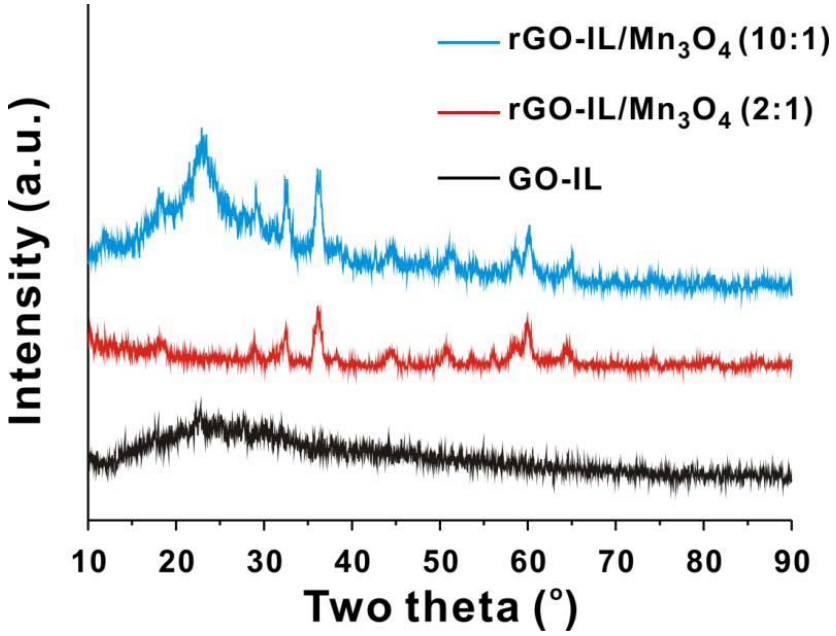

Figure S2. X-ray diffraction pattern of all samples used in this study.

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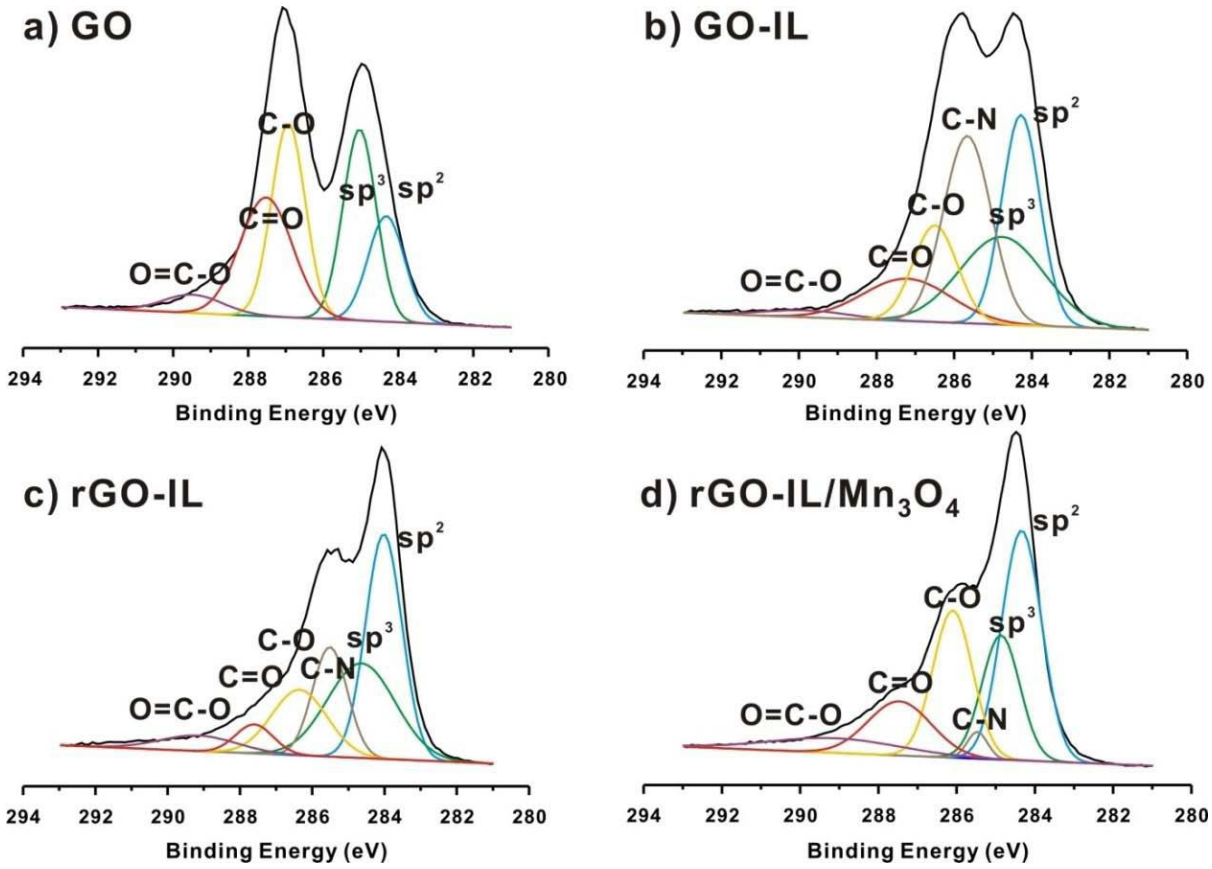

Figure S3. Deconvoluted high-resolution C1s XPS spectra of samples in this study. (a) GO, (b) GO-IL, (c) rGO-IL, and (d) rGO-IL/Mn_3O_4 (10:1).

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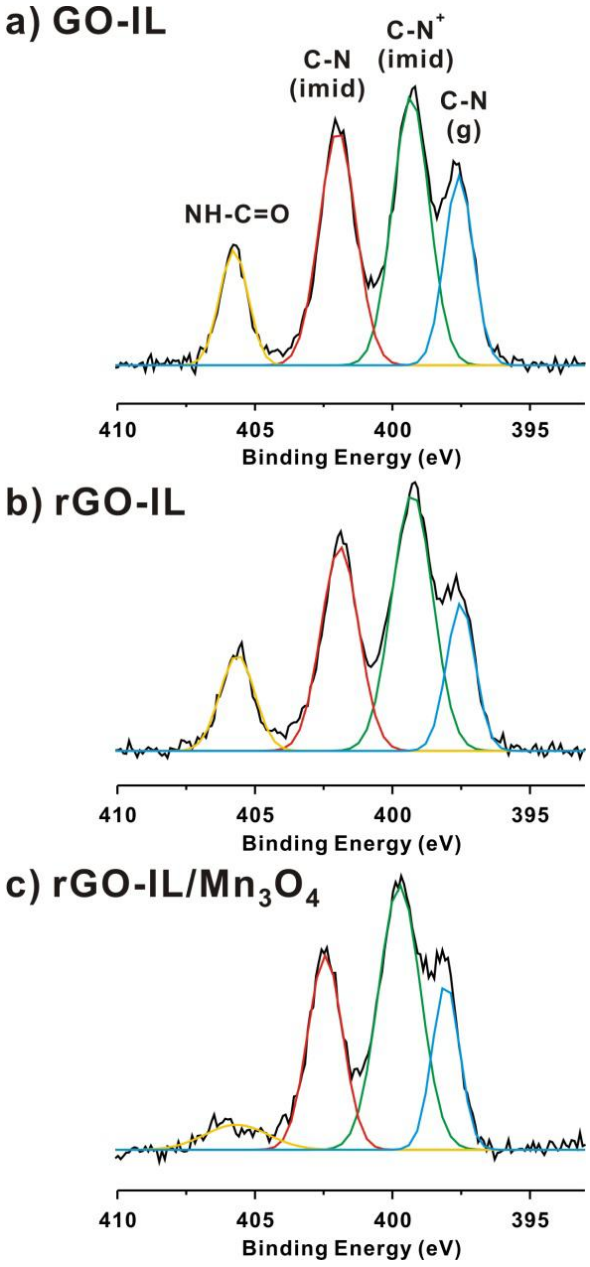

Figure S4. Deconvoluted high-resolution N1s XPS spectra of samples in this study. (a) GO, (b) rGO-IL and (c) rGO-IL/Mn_3O_4 (10:1).

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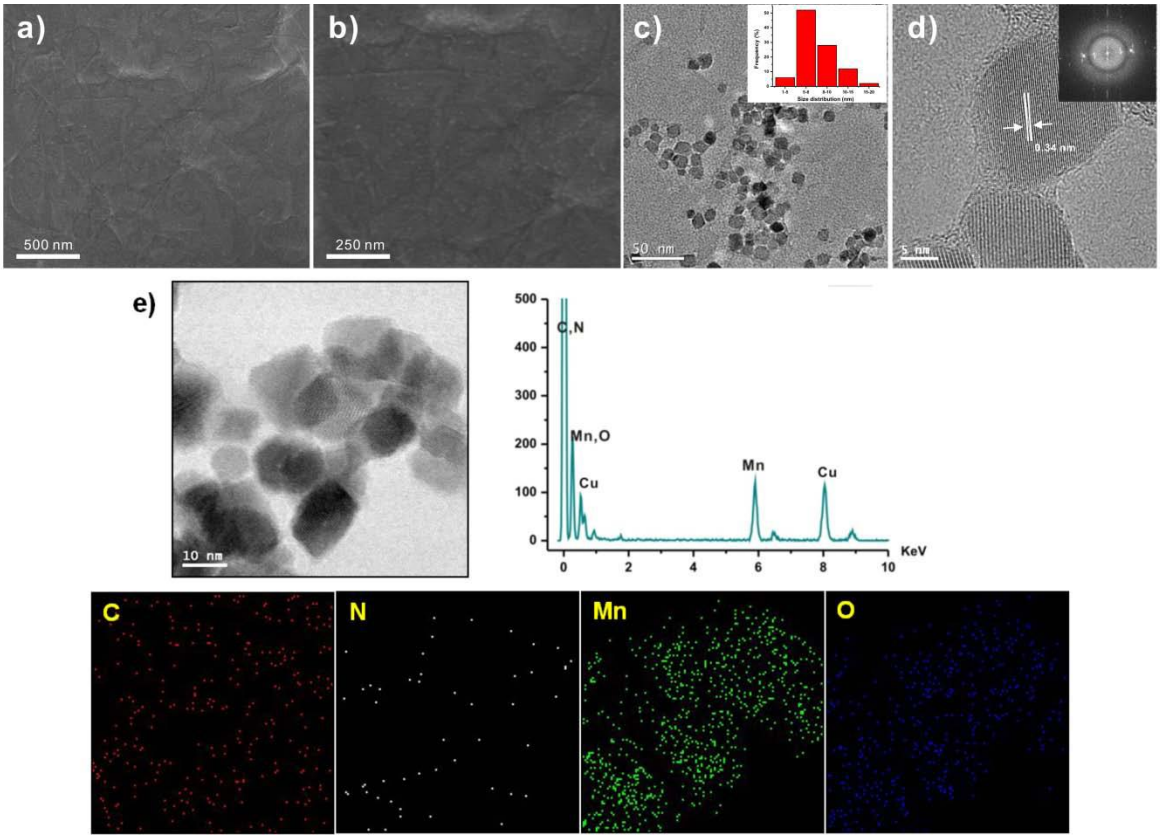

Figure S5. (a,b) High-magnification SEM images and (c) TEM image of rGO-IL/Mn_3O_4 (2:1) composites with size-distribution of Mn_3O_4 nanoparticles. (d) HRTEM image of Mn_3O_4 nanoparticles and the inset is the corresponding SAED pattern and (e) Elemental mapping image of hybrid rGO-IL/Mn_3O_4 (2:1).

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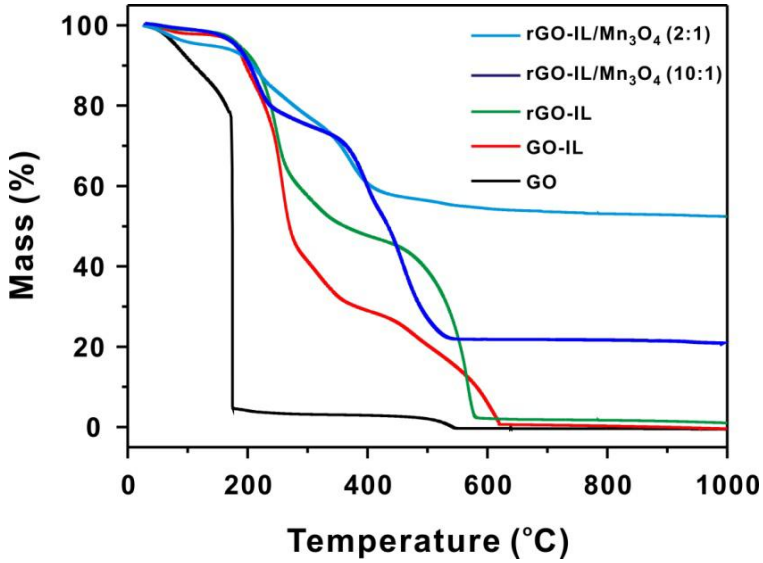

Figure S6. TGA thermograms of all samples used in this study. rGO-IL/Mn_3O_4 (2:1) and rGO-IL/Mn_3O_4 (10:1) show the relative percentage of Mn_3O_4 within the composite is 52.5% and 19.2%, respectively. The thermograms were obtained at a scan rate of 10 ^{o}C/min under air.

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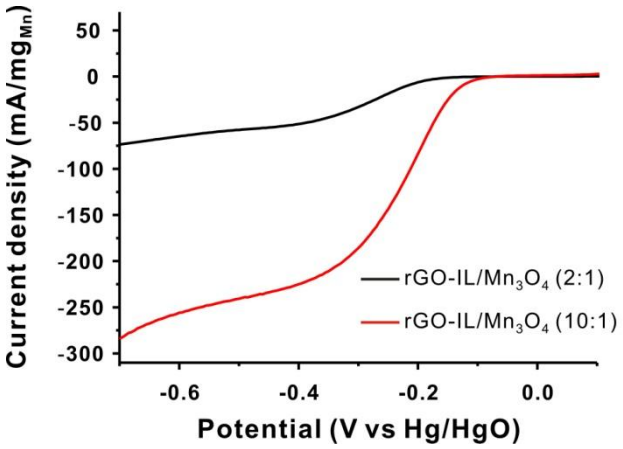

Figure S7. Half-cell data of rGO-IL/Mn_3O_4 samples with different Mn contents expressed by the normalization with the Mn content. Rotating disk electrode (RDE) experiments were conducted with the rotation rate 3200 rpm and the scan rate 10 mV/sec; 0.10 M KOH is used as an electrolyte. Pt wire and Hg/HgO is used as a counter and reference electrode with a 3-mm diameter working electrode, respectively.