

## **Supporting Information**

# **Robust InNCo<sub>3-x</sub>Mn<sub>x</sub> Nitride Supported Pt Nanoparticles as High Performance Bifunctional Electrocatalysts for Zn-Air Batteries**

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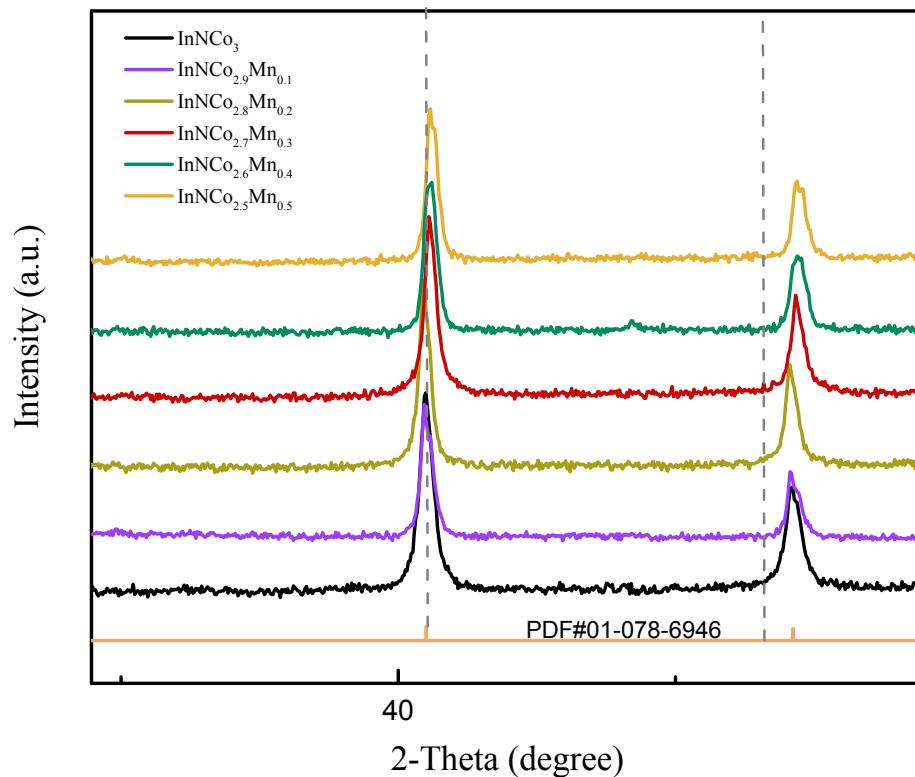
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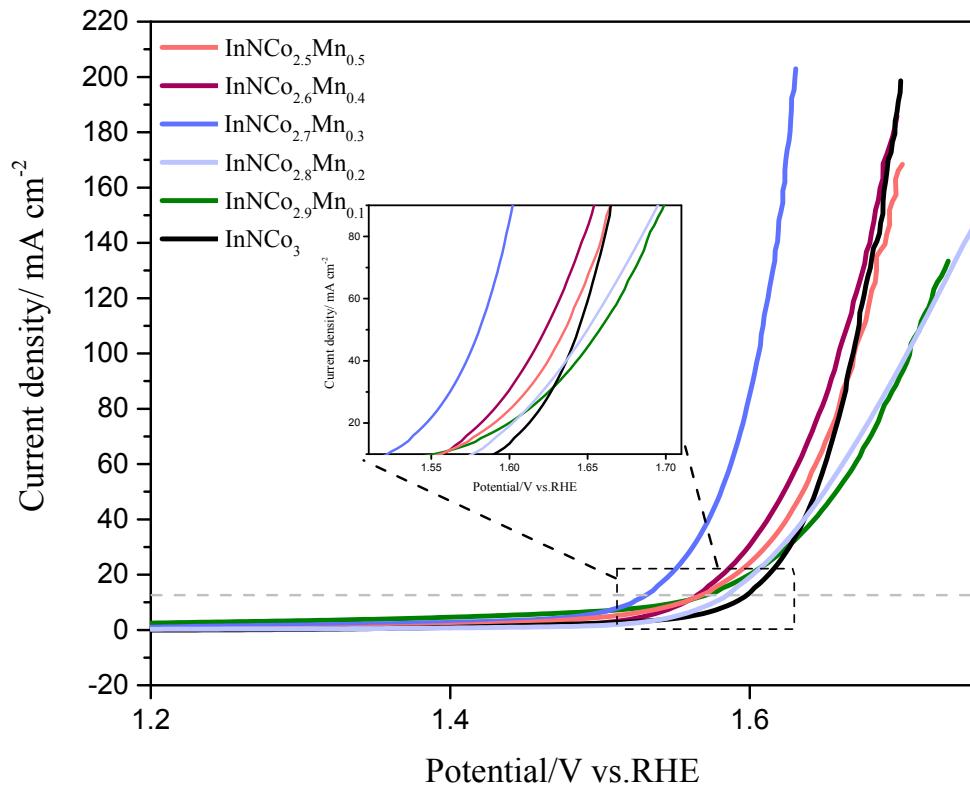
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## S1. X-Ray Powder Diffraction



**Figure. S1.** The doping of Mn atoms results in XRD peaks shift towards higher angles, suggesting the partial substitution of Co by the smaller atom Mn. In addition, the  $2\theta$  values have more positive shift with further increasing the amount of Mn.

## S2. OER polarization curves for $\text{InNC}\text{o}_3$ and Mn-doped samples



**Figure. S2.** OER polarization curves for  $\text{InNC}\text{o}_3$  and all the Mn-doped samples tests in 1M KOH solution. The OER plots have been zoomed to compare the overpotentials at 10  $\text{mA cm}^{-2}$ . The linear-sweep voltammograms (LSV) were after IR correction. It shows that doping Mn can greatly enhance the OER activity, which  $\text{InNC}\text{o}_{2.7}\text{Mn}_{0.3}$  demonstrated the lowest overpotential of 300 mV to reach the current density at 10  $\text{mA cm}^{-2}$ , followed by  $\text{InNC}\text{o}_{2.6}\text{Mn}_{0.4}$  (323 mV),  $\text{InNC}\text{o}_{2.5}\text{Mn}_{0.5}$  (327 mV),  $\text{InNC}\text{o}_{2.9}\text{Mn}_{0.1}$  (322 mV),  $\text{InNC}\text{o}_{2.8}\text{Mn}_{0.2}$  (344 mV) and  $\text{InNC}\text{o}_3$  (360 mV).

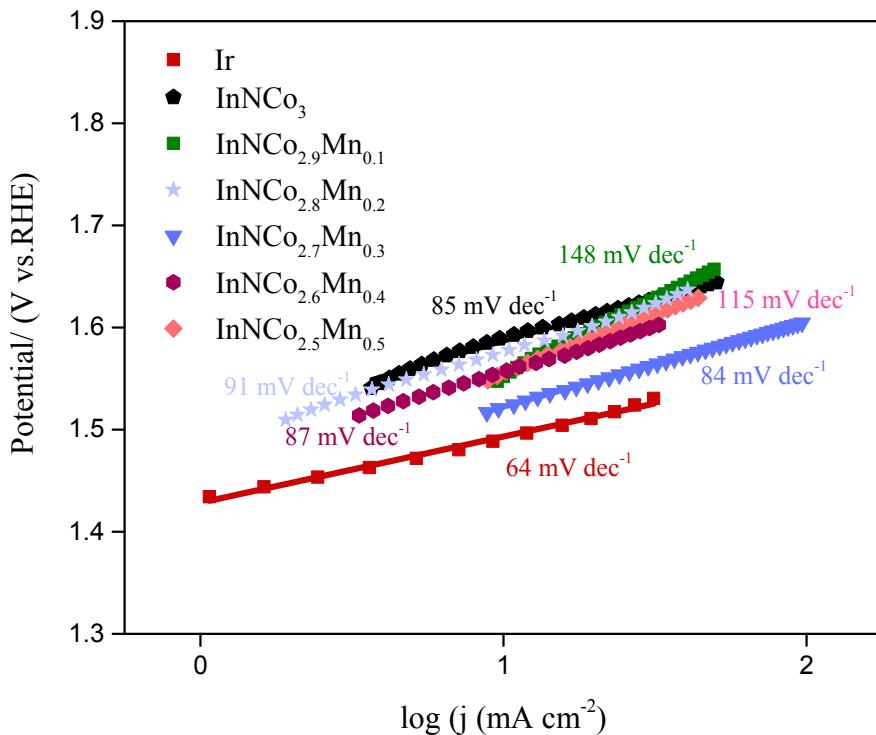
**Table S1. OER activity comparison**

**Table S1.** (OER activity comparison of as-prepared anti-perovskite InNCo<sub>3</sub> and Mn-doped samples with other superior non-noble OER catalysts previously reported.

Catalyst	Overpotentials (mV)	Tafel slop (mV dec <sup>-1</sup> )	Electrolyte concentration	Reference
<b>InNCo<sub>3</sub></b>	<b>360</b>	<b>85</b>	1M KOH	<b>this work</b>
<b>InNCo<sub>2.5</sub>Mn<sub>0.5</sub></b>	<b>327</b>	<b>115</b>	1M KOH	<b>this work</b>
<b>InNCo<sub>2.6</sub>Mn<sub>0.4</sub></b>	<b>323</b>	<b>87</b>	1M KOH	<b>this work</b>
<b>InNCo<sub>2.7</sub>Mn<sub>0.3</sub></b>	<b>300</b>	<b>84</b>	1M KOH	<b>this work</b>
<b>InNCo<sub>2.8</sub>Mn<sub>0.2</sub></b>	<b>344</b>	<b>91</b>	1M KOH	<b>this work</b>
<b>InNCo<sub>2.9</sub>Mn<sub>0.1</sub></b>	<b>322</b>	<b>148</b>	1M KOH	<b>this work</b>
CoN	290	70	1M KOH	1
Co <sub>4</sub> N/CNW/CC	310	81	1M KOH	2
CoP/CN	300	68	1M KOH	3
CoSn <sub>2</sub> /FTO	299	89	1M KOH	4
Ni <sub>3</sub> Ge <sub>2</sub> O <sub>5</sub> (OH) <sub>4</sub>	320	67.5	1M KOH	5
MnO <sub>2</sub> -0.5IL	394	49	1M KOH	6
P-Co-NC-4	315	75.7	1M KOH	7
Ni-MnO/rGO	370	67	0.1M KOH	8
BCFSn-721	300	69	0.1M KOH	9

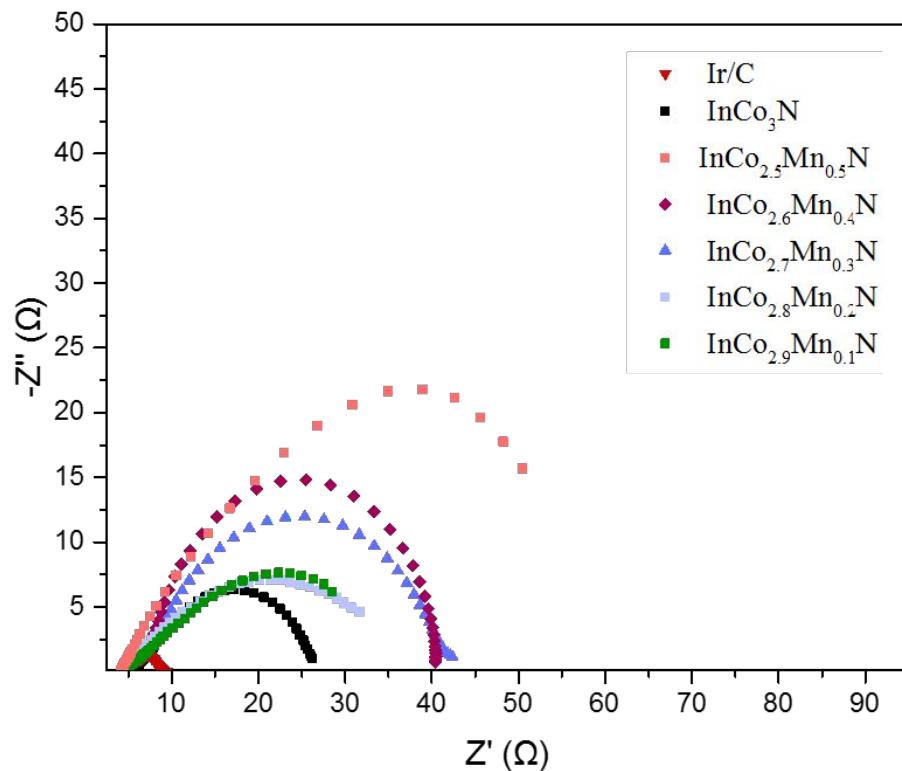
NiCo-LDH-G	337	52	0.1M KOH	10
Co-N, B-CSs	430	-	0.1M KOH	11
LCF-700	293	67	0.1M KOH	12

### S3. Tafel slope



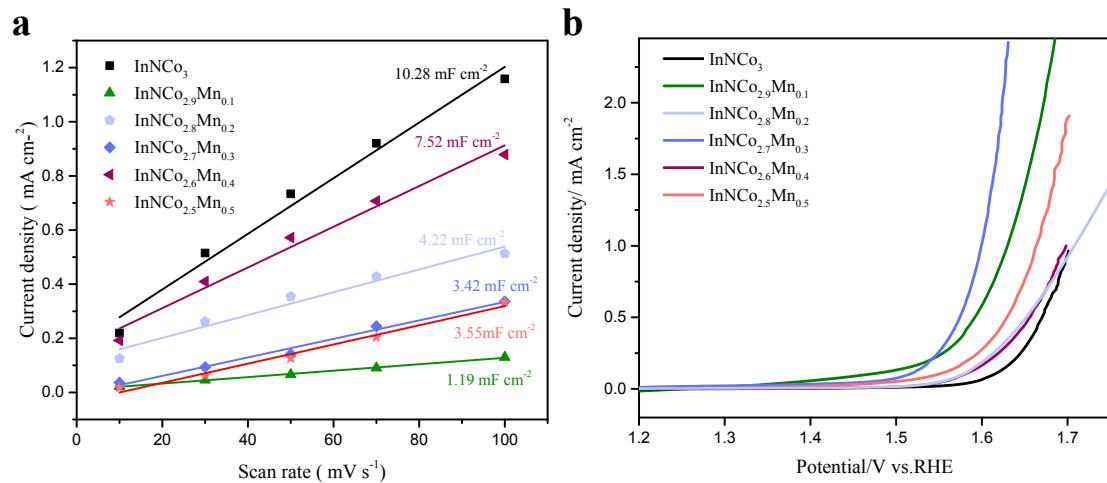
**Figure. S3.** Tafel slopes of as-prepared anti-perovskite nitride samples and commercial Ir/C. This comparison clearly showed that doping Mn can significantly improve the OER performance and electronic conductivity as well, thus leading to a faster reaction. InNCo<sub>3</sub> yields a competitively high Tafel slop of 85 mV dec<sup>-1</sup> while InNCo<sub>2.7</sub>Mn<sub>0.3</sub> shows a similarly Tafel slop of 84 mV dec<sup>-1</sup>. The Tafel slop of InNCo<sub>2.6</sub>Mn<sub>0.4</sub>, InNCo<sub>2.8</sub>Mn<sub>0.2</sub> InNCo<sub>2.5</sub>Mn<sub>0.5</sub> and InNCo<sub>2.9</sub>Mn<sub>0.1</sub> are 87 mV dec<sup>-1</sup>, 91 mV dec<sup>-1</sup>, 115 mV dec<sup>-1</sup> and 148 mV dec<sup>-1</sup>, respectively.

## S4. Electrochemical impedance spectroscopy (EIS)



**Figure. S4.** The Nyquist plots of as-prepared anti-perovskite nitride samples and commercial Ir/C. The resistance of the solution was around 5.36, which can be observed from the X intercept. The radius of the semicircles represented the charge-transfer resistance  $R_{ct}$ . The  $R_{ct}$  of InNCo<sub>3</sub> was 10.33, much smaller than InNCo<sub>2.7</sub>Mn<sub>0.3</sub> (18.5), InNCo<sub>2.95</sub>Mn<sub>0.05</sub> (18.7) and InNCo<sub>2.9</sub>Mn<sub>0.1</sub> (37.5), indicating a lower resistance.

## S5. ECSA normalized polarization curves



**Figure. S5.** (a) The  $C_{dl}$  values of InNCo<sub>3-x</sub>Mn<sub>x</sub> measured by the CV scan between 1.3 V and 1.4 V (vs. RHE) under different scan rate of 10 mV s<sup>-1</sup>, 30 mV s<sup>-1</sup>, 50 mV s<sup>-1</sup>, 70 mV s<sup>-1</sup> and 100 mV s<sup>-1</sup>. (b) ECSA normalized polarization curves for the as-prepared anti-perovskite nitrides samples.

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