Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supporting Information

Selenium doped Co-Fe mixed metal oxide decorated on g-C_3N_4 and MXenes as bifunctional Oxygen electrocatalyst for rechargeable Zn-Air battery

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Figure S1. Photographic images of (a) SgCN, (b) CF/SgCN and (c) SeCF-MMO/ SgCN:MX powder.

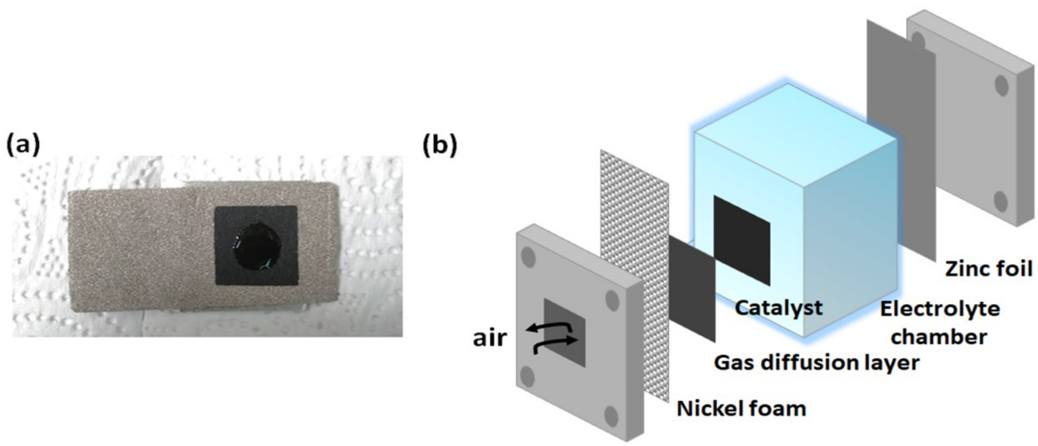

Figure S2. (a) Photographic image of electrocatalyst electrode and (b) schematic diagram of home-made zinc/air cell.

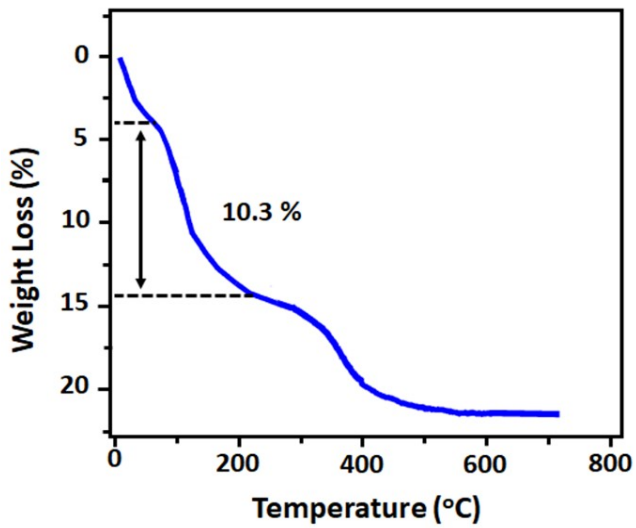

Figure S3. Thermogravimetric analysis for CoFe-LDH compound (CF sample).

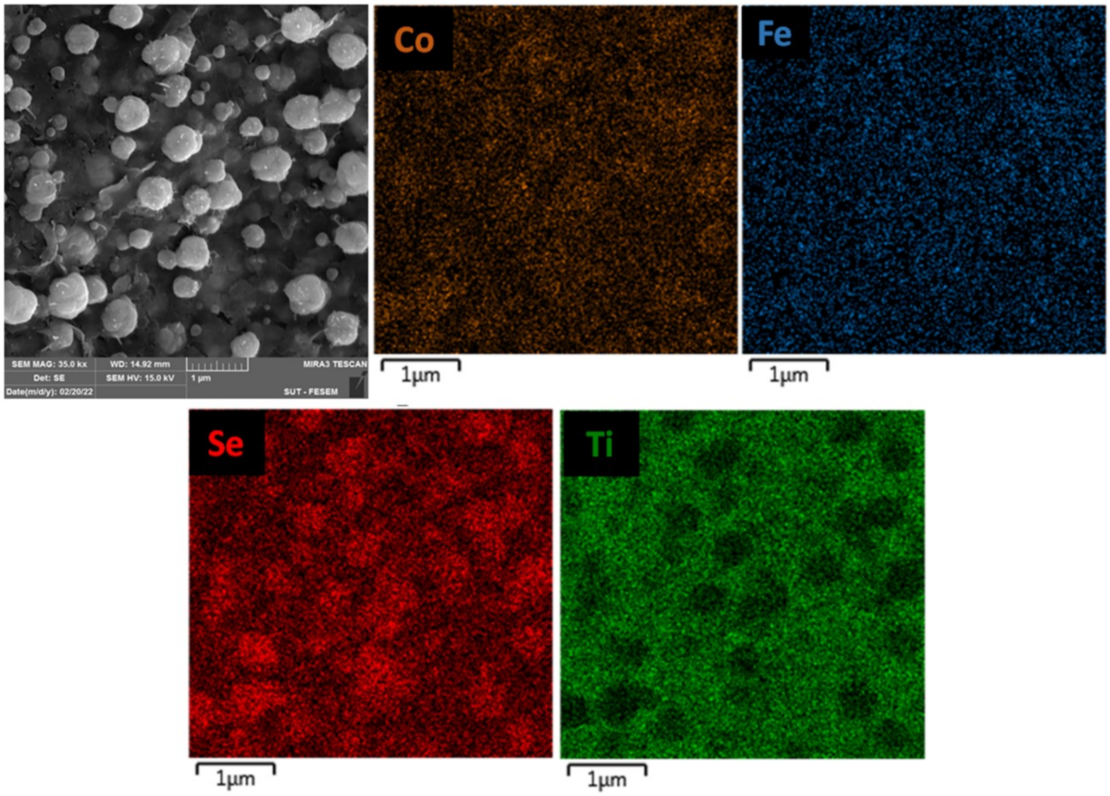

Figure S4. The Energy Dispersive Spectroscopy (EDS) mapping of Se-doped CoFe Mixed Metal Oxide/S-doped g-C_3N_4:$Ti_3C_2T_x$ (SeCF-MMO/SgCN:MX) sample.

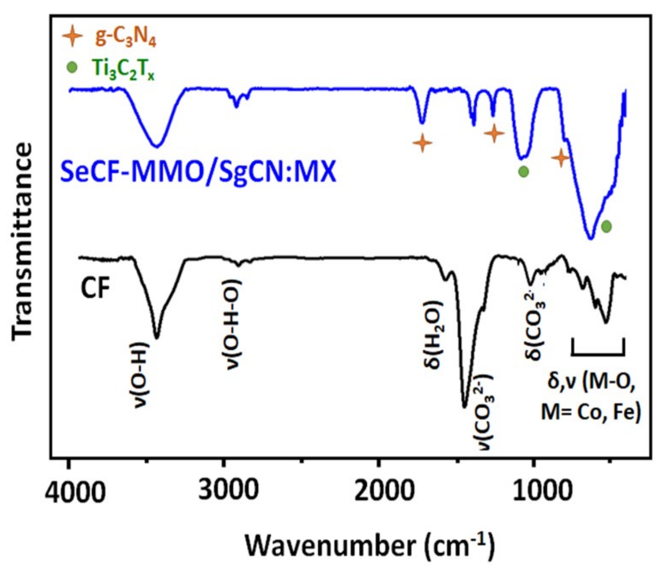

Figure S5. FT-IR spectra of CF and SeCF-MMO/SgCN:MX.

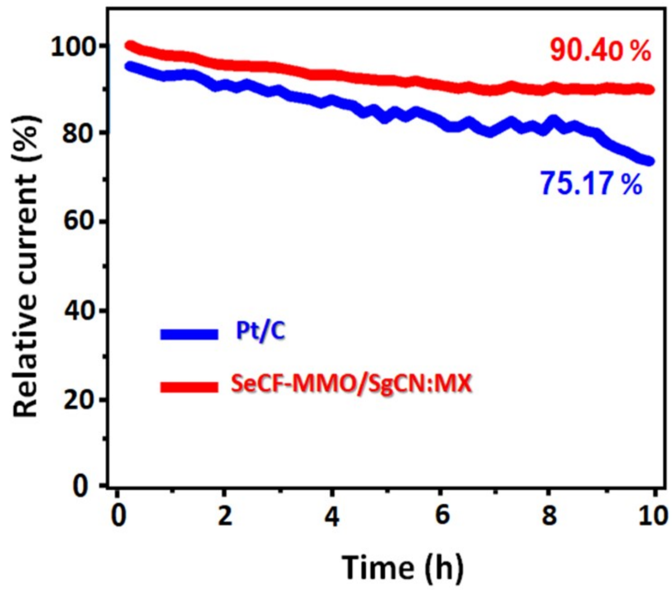

Figure S6. The ORR stability of Pt/C and SeCF-MMO/SgCN:MX samples.

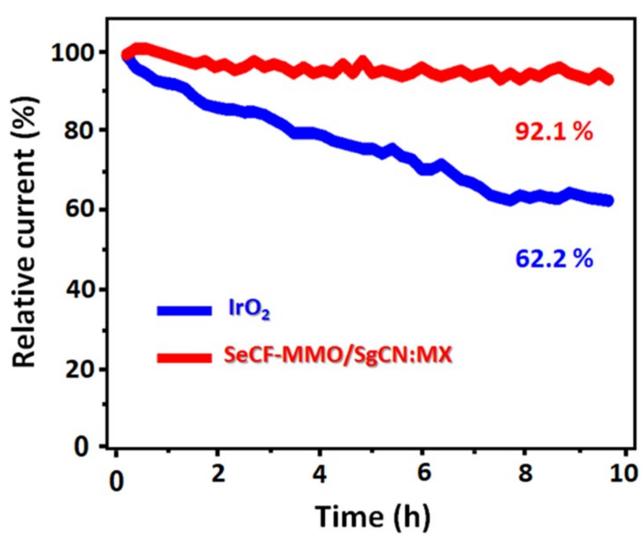

Figure S7. The OER stability of IrO_2 and SeCF-MMO/SgCN:MX samples.

Table S1. Elemental ratios calculated by ICP (Inductively Coupled Plasma) analysis for CoFe-LDH compound.

Sample	Mass ratio %		Relative atomic ratio	
	Co	Fe	Co	Fe
$[Co_{0.75}Fe_{0.25}(OH)_2](CO_3^{2-})_{0.125}.0.64H_2O$	76.01	24.02	0.75	0.25

Table S2. Comparison electrocatalysts behavior of previously electrocatalyst reported and this work.

Catalyst	**Onset potential (V *vs* RHE)**	**Half potential (V *vs* RHE)**	**Limiting current density (mA cm^{-2})**	**Ref**
AC-HC	0.92	0.77	Large	[1]
CNT/Ag1/CNF	0.874	0.724	-5.1	[2]
Fe-N-C/HPCS@CNT		0.873	6.01	[3]
$Pt_{1.1}Fe_{8.8}$NiPF	1.0	0.87		[4]
Co@IC/MoC@PC	1.034	0.875	5.89	[5]
Ag/Ag_2O @MCOF(Co)	0.87	0.76	-4.8	[6]
FeCo SAs@Co/N-GC		0.88	6.70	[7]
		Pt/C (0.84)		
$Co_{0.25}Ni_{0.75}$@NCNT30	0.94	0.84		[8]
FeCo/N-CNTs@CC	0.87	0.78	5.63	[9]
MnCoNi-C-D	0.91	0.82		[10]
V-Co_3O_4		0.821		[11]
$CoWO_4$/WS_2@C-N	1.15	0.87		[12]
$NiCo_2O_4$/N-G	0.90	0.72	5.27	[13]
FeCO@NS-CA	0.97	0.87	5.81	[14]
Co_3O_4/NEGF	0.94	0.80		[15]
ZnCoFe-NC	0.95	0.878		[16]
MnCoNi-C-D	0.91	0.82		[10]
FeCo/Co_2P@NPCF	0.85	0.79		[17]
Co/N@CNTs@CNMF800	0.99	0.86		[18]
BFC-FC-0.2	1.03	0.9		[19]
	Pt/C (1.02)	Pt/C (0.89)		
Co@NCNTA-700	0.973	0.861		[20]
(Cu, Co)$_3$oS_3@CNT-C_3N_4	0.8			[21]
NiO/ $NiCo_2O_4$	0.89	0.73	4.77	[22]
N-C/Co-1	0.94	0.86		

$NiCo_2S_4$/RGO0.02		0.78		[23]
Fe20@N/HCSs		0.85	5.75	[24]
Co3HITP2	0.91	0.8	5.52	[25]
NF@$Co_{3-x}Ni_xO_4$	0.91	0.8	1.4	[26]
ONPC	0.95	0.79	5.8	[27]
IOSHs-NSC-Co_9S_8		0.82	5.35	[28]
PtFe-DCNT	0.95	0.84	5.3	[29]
MNG-CoFe	0.98	-	-	[30]
Mn_3O_4/O-CNTs	0.92	0.85		[31]
$NiFe_2O_4$/$FeNi_2S_4$ HNSs	0.715			[32]
FeN_x-embedded PNC	0.997	0.86		[33]
CoO-NSC-800		0.74	5.5	[34]
Co-N, B-CSs		0.83	5.66	[35]
Co_2P@CNF	0.915	0.803	5.27	[36]
$CuCoO_x$/FeOOH	0.89	0.78	5.3	[37]
Co_9S_8/CD@NSC		0.84		[38]
Mn/Co-N-C0.02-800	0.90	0.80	5.3	[39]
3D Co-N-C NN	1.05 Pt/C (1.04)		6.3 Pt/C (5.6) pt loading of 28.2 wt.%)	[40]
NiO/CoN PINWs	0.89 Pt (0.95)	0.68 Pt (0.78)		[41]
SeCF-MMO/SgCN:MX	1.04	0.8	6.01	This work

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