Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Synthesis of efficient photocatalysts for water oxidation and dye degradation reactions using $CoCl_2$ eutectics

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Salt mixture A/B	A content, wt. %	B content, wt. %	Eutectic melting point, °C
$NaCl/CoCl_2$	55.6	44.4	370
$KCl/CoCl_2$	42.7	57.3	351
$ZnCl_2/CoCl_2$	93.0	7.0	312
$SnCl_2/CoCl_2$	97.9	2.1	240

Table S1. Composition and melting points of the $CoCl_2$-containing eutectic salt mixtures used in the studies[1].

Product from the indicated melt	C, wt.%	N, wt.%	H, wt.%	O, wt. %	Cl, wt. %	Co, wt. %	C/N	S_{BET}, m^2/g
$NaCl/CoCl_2$	26.5	42.6	3.1	19.9	2.6	5.3	0.62	51
$KCl/CoCl_2$	26.8	45.3	3.1	17.7	1.4	5.7	0.59	28
$ZnCl_2/CoCl_2$	22.9	39.5	3.0	19.9	9.5	5.2	0.58	15
$SnCl_2/CoCl_2$	27.4	43.2	2.9	20.8	2.5	3.2	0.63	6
Ref.-CN	35.0	60.0	2.1	2.9	-	-	0.58	1

Table S2. Composition and BET surface areas of the products prepared at 1:5 precursor to salt weight ratio, according to elemental analysis, EDS and ICP.

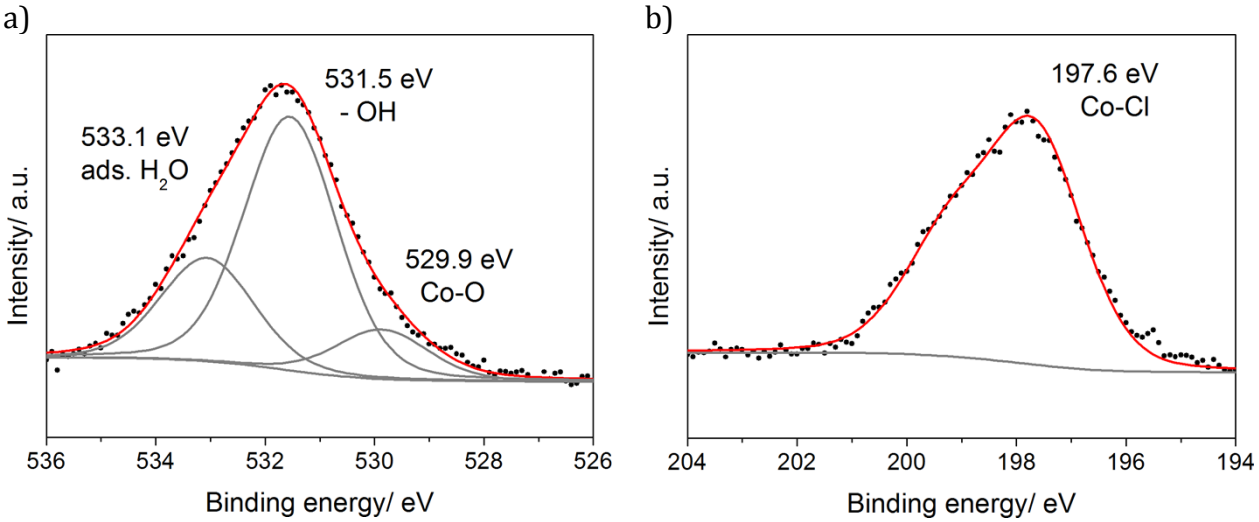

Figure S1. O1s (a) and Cl2p (b) XPS spectra of $KCl/CoCl_2$ derived product.

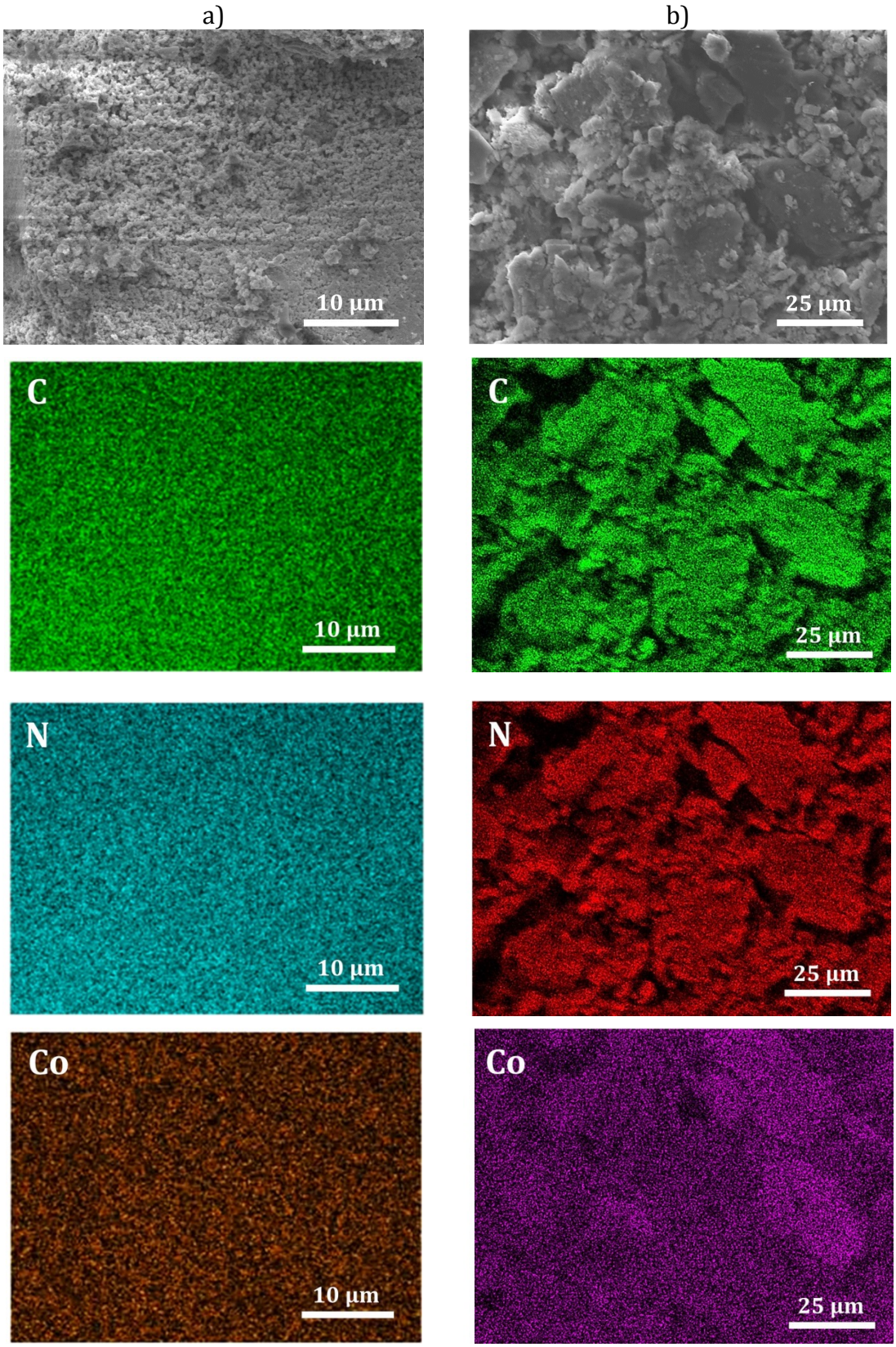

Figure S2. SEM images and the corresponding elemental maps of C, N and Co of the composites prepared in $KCl/CoCl_2$ (a) and $SnCl_2/CoCl_2$ (b) eutectics at 1:5 and 1:10 ratios, respectively.

DCDA : Salts weight ratio	C, wt.%	N, wt.%	H, wt.%	O, wt. %	Cl, wt. %	Co, wt. %	Sn, wt. %	C/N	S_{BET}, m^2/g
1:1	29.5	48.1	2.7	12.2	1.4	0.4	5.7	0.61	31
1:2	28.4	45.8	2.8	19.9	0.7	1.3	1.1	0.62	32
1:5	26.8	42.3	2.9	19.0	2.3	3.2	3.5	0.63	6
1:10	25.1	38.1	3.3	23.6	2.8	3.8	3.3	0.66	19
1:20	18.6	28.4	2.8	29.3	2.3	4.4	14.2	0.66	56

Table S3. Composition and BET surface areas of the products prepared in $SnCl_2/CoCl_2$ using different precursor to salts weight ratio, according to elemental analysis, EDS and ICP.

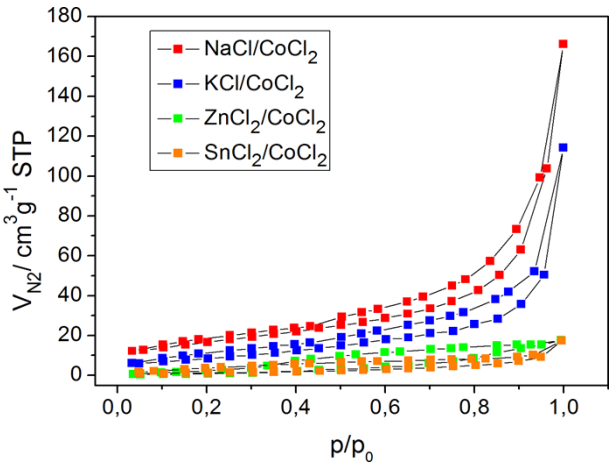

Figure S3. N_2 sorption isotherms of $CoCl_2$-derived products.

Product from the indicated melt	**Set up 1**		**Set up 2**
	Activity µmol/h	O_2 selectivity* %	Activity µmol/h
$NaCl/CoCl_2$	11	88	below the detection limit
$KCl/CoCl_2$	16	88	0.5
$ZnCl_2/CoCl_2$	27	83	1.1
$SnCl_2/CoCl_2$	15	99	below the detection limit
CNS/3% Co_3O_4	32	83	1.5

* O_2 selectivity: $O_2/(O_2 + N_2)$

Table S4. Summary of the activity of the $CoCl_2$-derived products and reference composite prepared by the three-step procedure reported in literature[2] in photocatalytic water oxidation using two different set ups described in the Experimental Section.

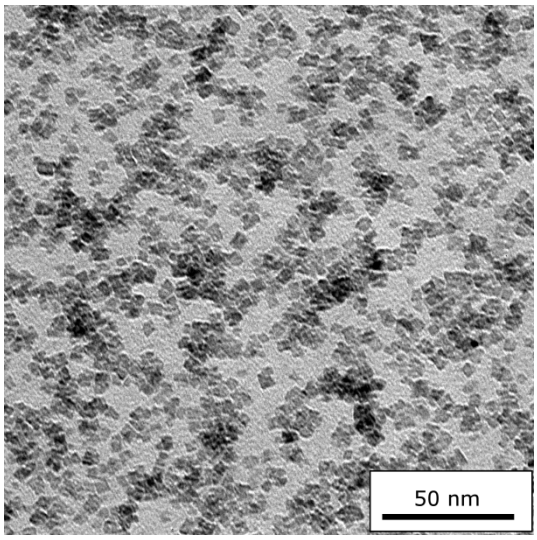

Figure S4. TEM image of Co_3O_4 NPs used to prepare the reference composite for oxygen evolution according to the reported procedure[2].

1. G. J. Janz, C. B. Allen, J. R. Downey Jr. and R. P. T. Tomkins, *Physical Properties Data Compilations Relevant to Energy Storage*, New York, 1978.
2. J. Zhang, M. Grzelczak, Y. Hou, K. Maeda, K. Domen, X. Fu, M. Antonietti and X. Wang, *Chem. Sci.*, 2012, **3**, 443.