

Supporting Information

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

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Salt mixture	A content,	B content,	Eutectic melting point,
A/B	wt. %	wt. %	°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 CoCl₂-containing eutectic salt mixtures used in the studies¹.

Product from	C,	N,	H,	O,	Cl,	Co,	C/N	S_{BET},
the indicated melt	wt.%	wt.%	wt.%	wt. %	wt. %	wt. %		m²/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.

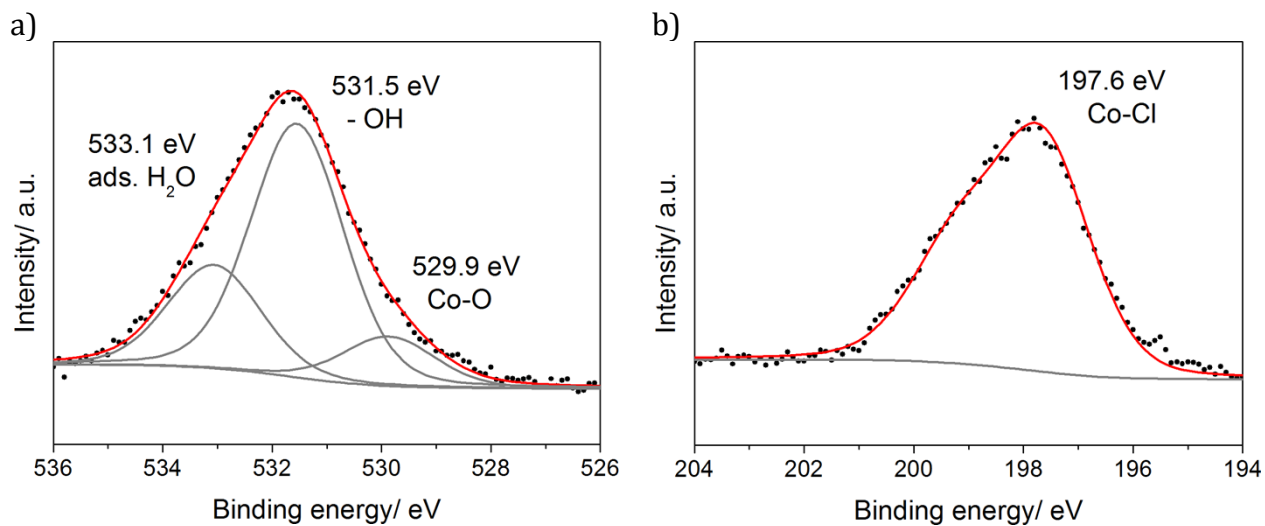


Figure S1. O1s (a) and Cl2p (b) XPS spectra of KCl/CoCl₂ derived product.

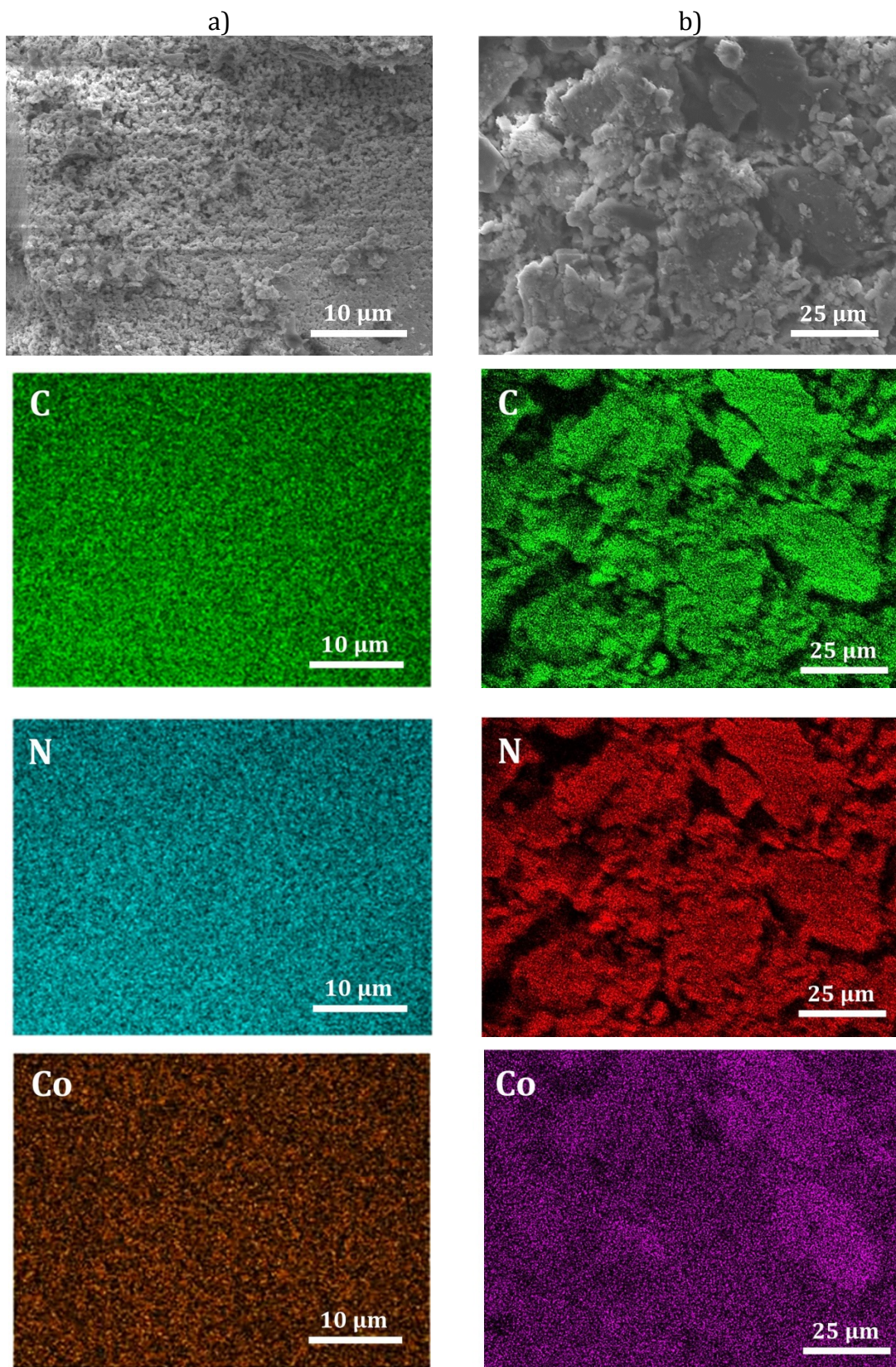


Figure S2. SEM images and the corresponding elemental maps of C, N and Co of the composites prepared in KCl/CoCl₂ (a) and SnCl₂/CoCl₂ (b) eutectics at 1:5 and 1:10 ratios, respectively.

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 SnCl₂/CoCl₂ using different precursor to salts weight ratio, according to elemental analysis, EDS and ICP.

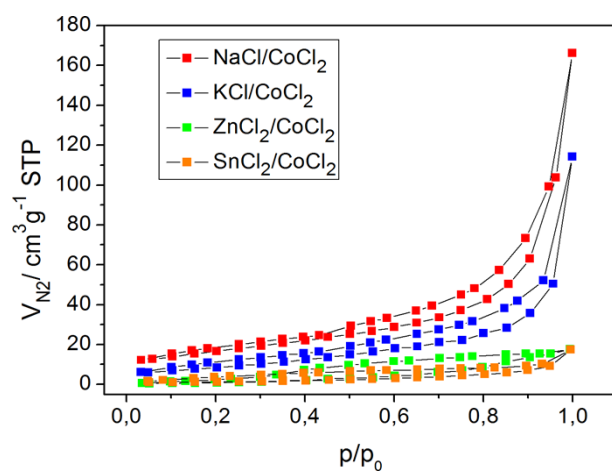


Figure S3. N₂ sorption isotherms of CoCl₂-derived products.

Product from the indicated melt	Set up 1		Set up 2
	Activity $\mu\text{mol/h}$	O ₂ selectivity* %	Activity $\mu\text{mol/h}$
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 ₃ O ₄	32	83	1.5

* O₂ selectivity: $\text{O}_2/(\text{O}_2 + \text{N}_2)$

Table S4. Summary of the activity of the CoCl₂-derived products and reference composite prepared by the three-step procedure reported in literature² in photocatalytic water oxidation using two different set ups described in the Experimental Section.

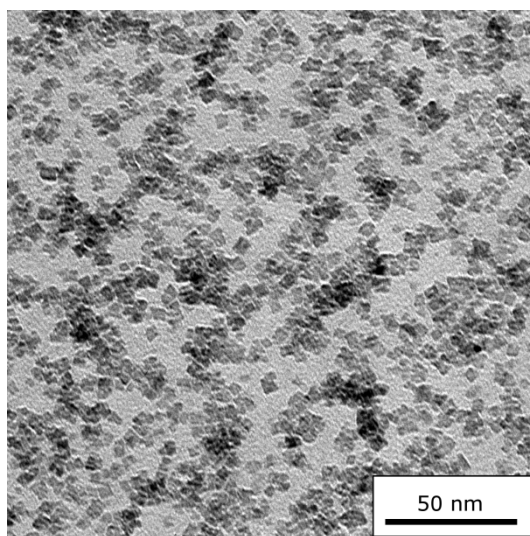


Figure S4. TEM image of Co₃O₄ NPs used to prepare the reference composite for oxygen evolution according to the reported procedure².

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.