

## SUPPORTING INFORMATION

TO

### **An easy and support-free synthesis of bimetallic borates for boosting the oxygen evolution reaction**

*Sergio García-Dalí<sup>1,2,\*</sup>, Javier Quílez-Bermejo<sup>1,3</sup>, Raj Karthik<sup>1</sup>, Rafael Luan Sehn Canevesi<sup>1</sup>,  
María T. Izquierdo<sup>4</sup>, Mélanie Emo<sup>5</sup>, Alain Celzard<sup>1,6</sup>, Vanessa Fierro<sup>1,\*</sup>.*

<sup>1</sup>Université de Lorraine, Centre National de la Recherche Scientifique (CNRS), Institut Jean Lamour (IJL), F-88000, Épinal, France.

<sup>2</sup>Departamento de Ciencia de los Materiales e Ingeniería Metalúrgica, Universidad de Oviedo, 33004, Oviedo, Spain.

<sup>3</sup>Departamento de Química Inorgánica and Instituto de Materiales, Universidad de Alicante, Ap. 99, 03080, Spain

<sup>4</sup>Instituto de Carboquímica (ICB-CSIQ), Miguel Luesma Castán 4, E-50018, Zaragoza, Spain.

<sup>5</sup>Université de Lorraine, Centre National de la Recherche Scientifique (CNRS), Institut Jean Lamour (IJL), F-54000, Nancy, France.

<sup>6</sup>Institut Universitaire de France (IUF)

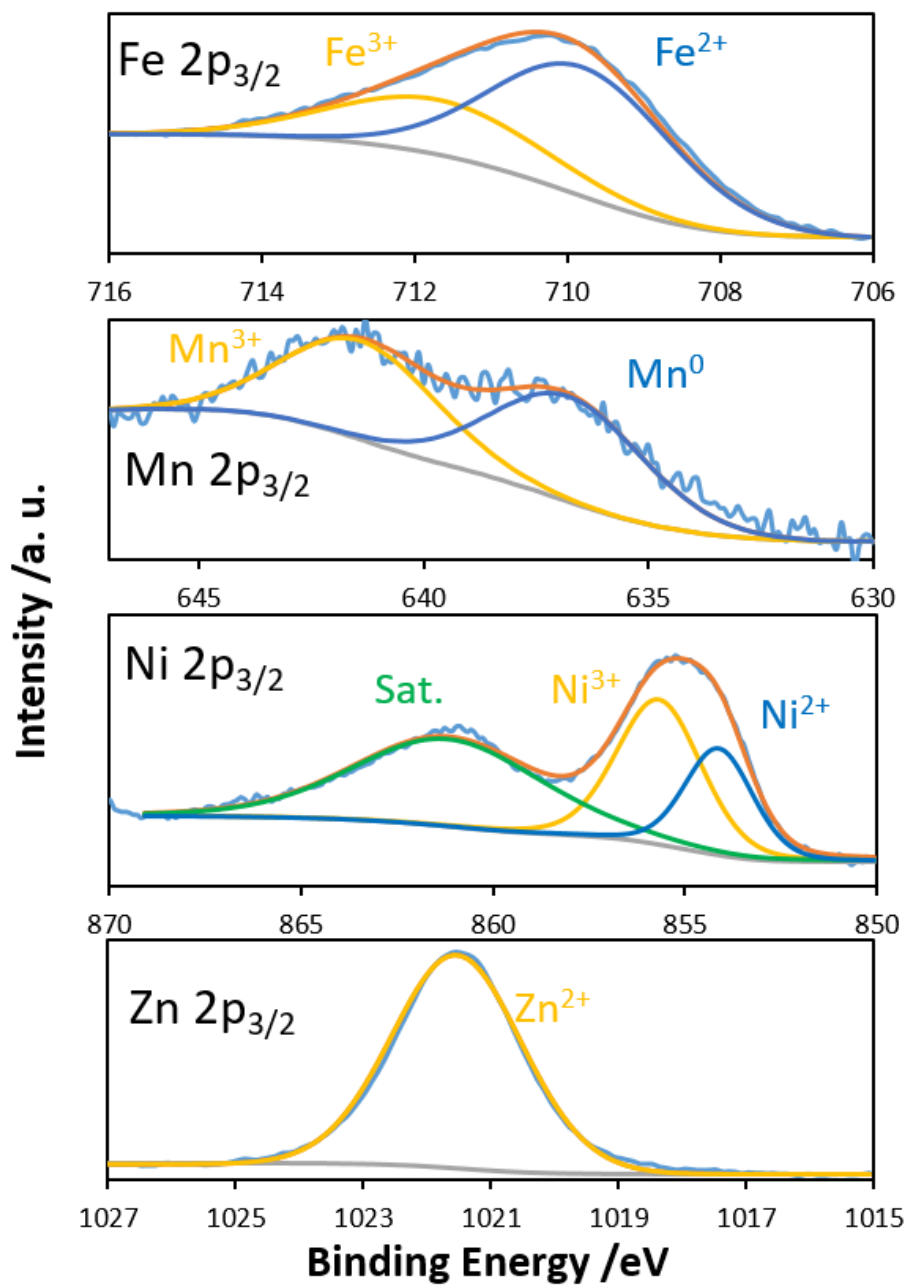


Figure S1: From top to bottom: XPS spectra of Fe 2p<sub>3/2</sub> in Fe@CoB<sub>i</sub>, Mn 2p<sub>3/2</sub> in Mn@CoB<sub>i</sub>, Ni 2p<sub>3/2</sub> in Ni@CoB<sub>i</sub> and Zn 2p<sub>3/2</sub> in Zn@CoB<sub>i</sub>.

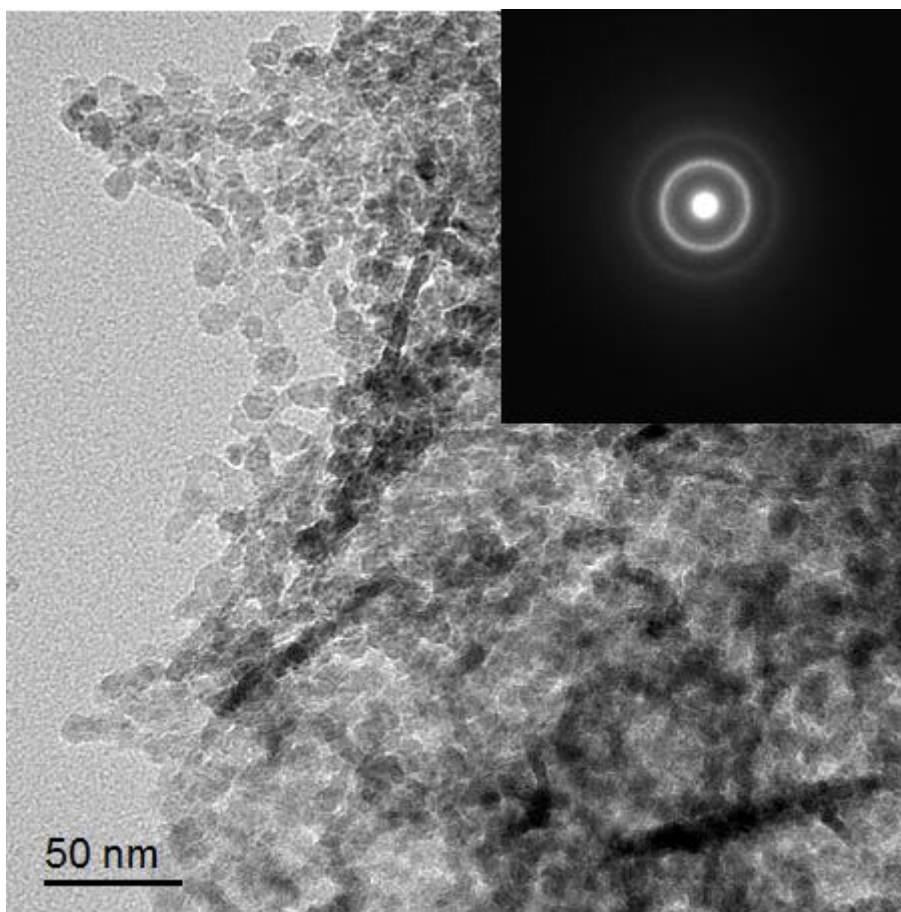


Figure S2: TEM of CoB<sub>1</sub> with the corresponding SAED pattern (inset).

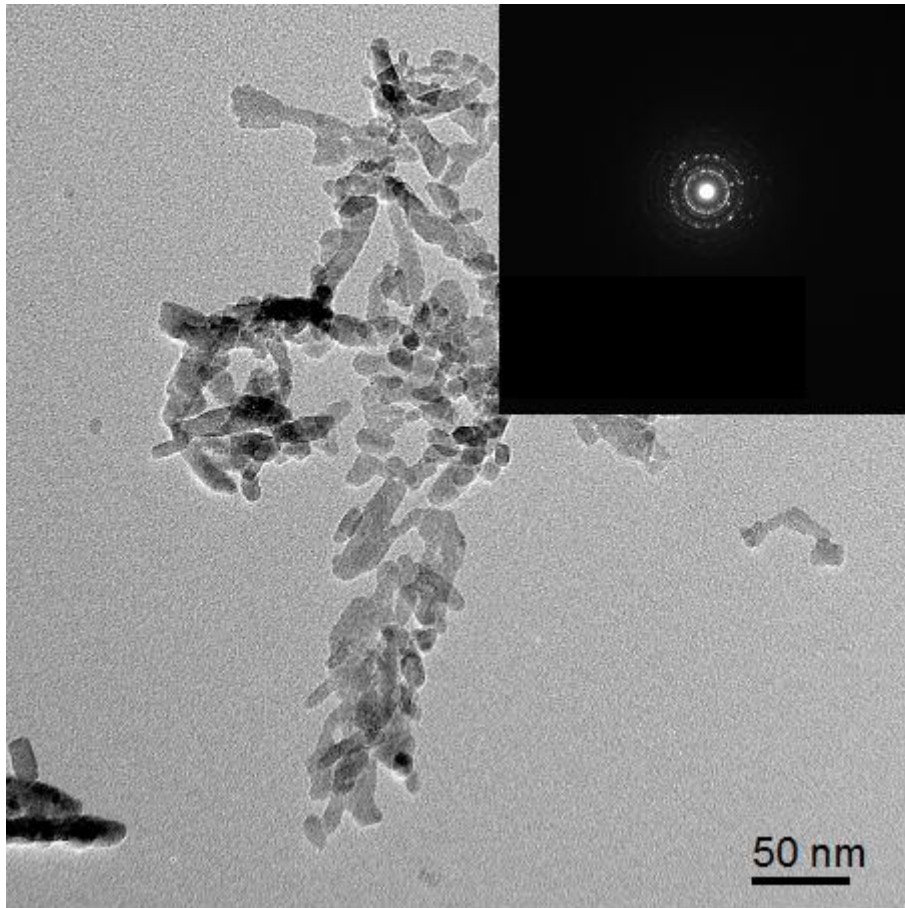


Figure S3: TEM of Fe@CoB, with the corresponding SAED pattern (inset).

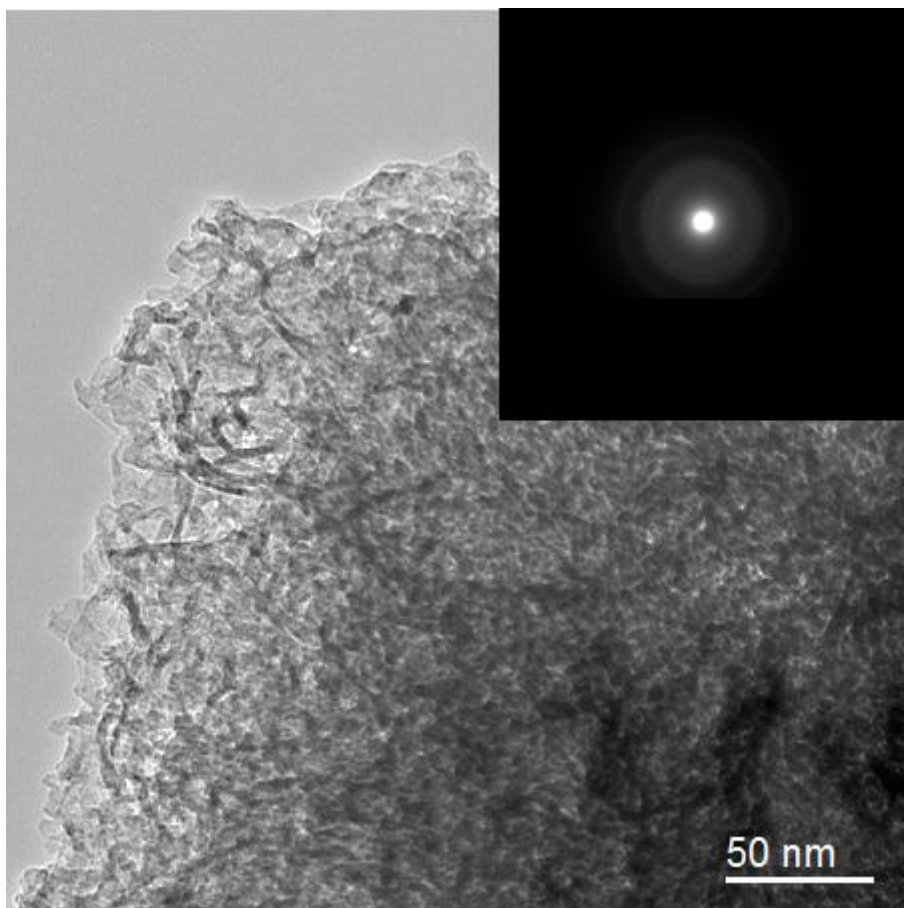


Figure S4: TEM of Mn@CoB<sub>1</sub> with the corresponding SAED pattern (inset).

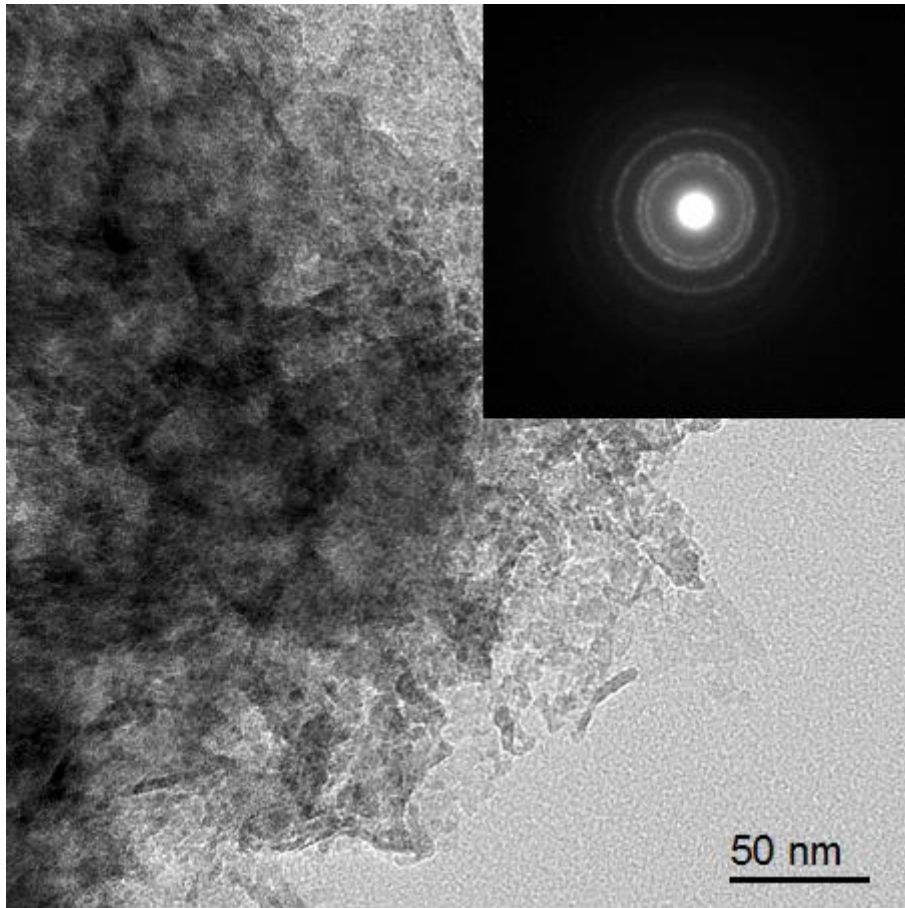


Figure S5: TEM of Ni@CoB<sub>1</sub> with the corresponding SAED pattern (inset).

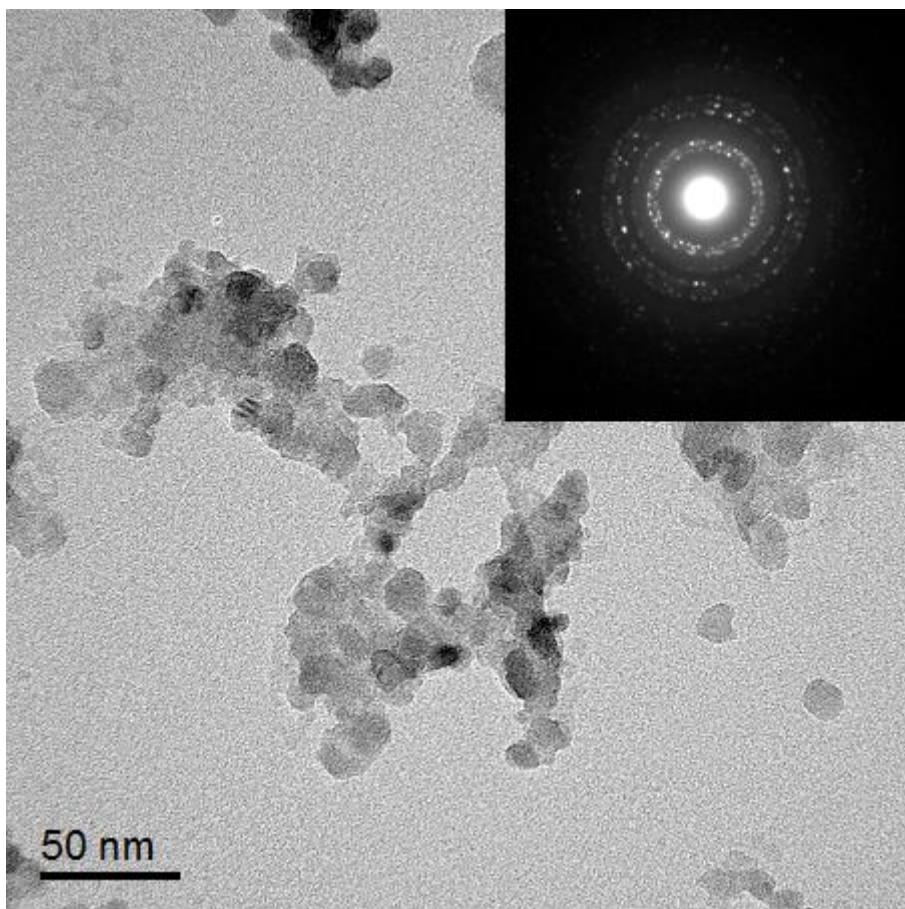


Figure S6: TEM of Zn@CoB<sub>3</sub> with the corresponding SAED pattern (inset).

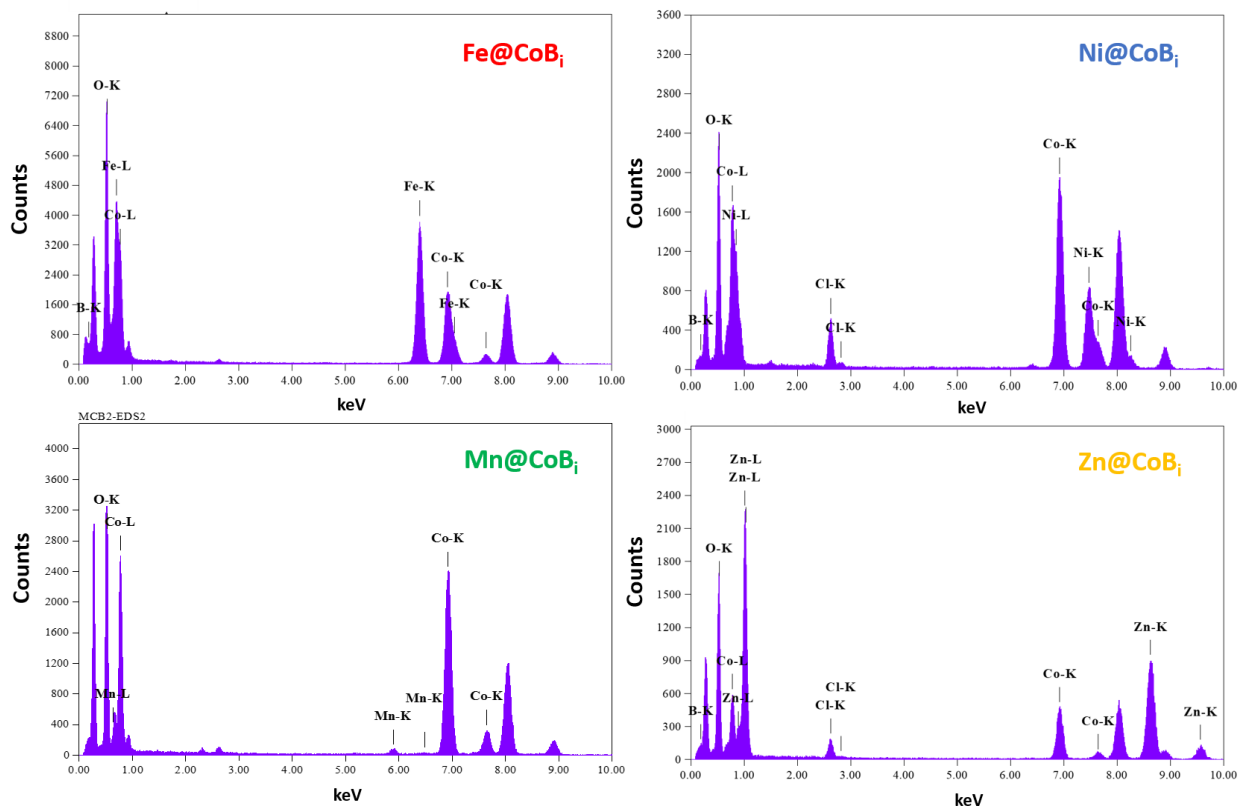


Figure S7: EDX spectra of all doped cobalt borates.



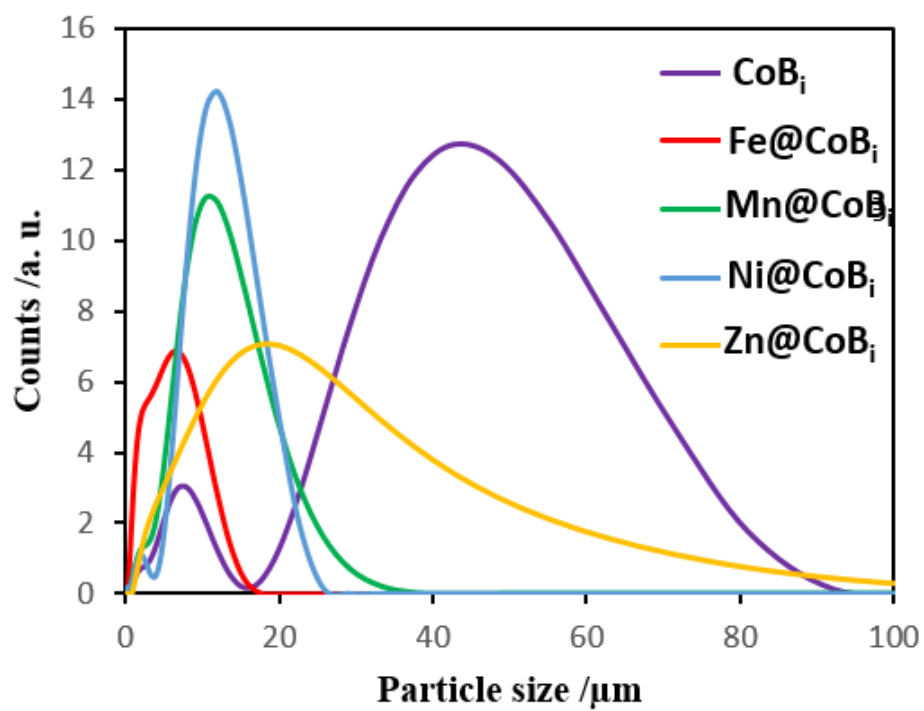


Figure S8: Particle size distribution of CoB<sub>i</sub>, Fe@CoB<sub>i</sub>, Mn@CoB<sub>i</sub>, Ni@CoB<sub>i</sub> and Zn@CoB<sub>i</sub>.

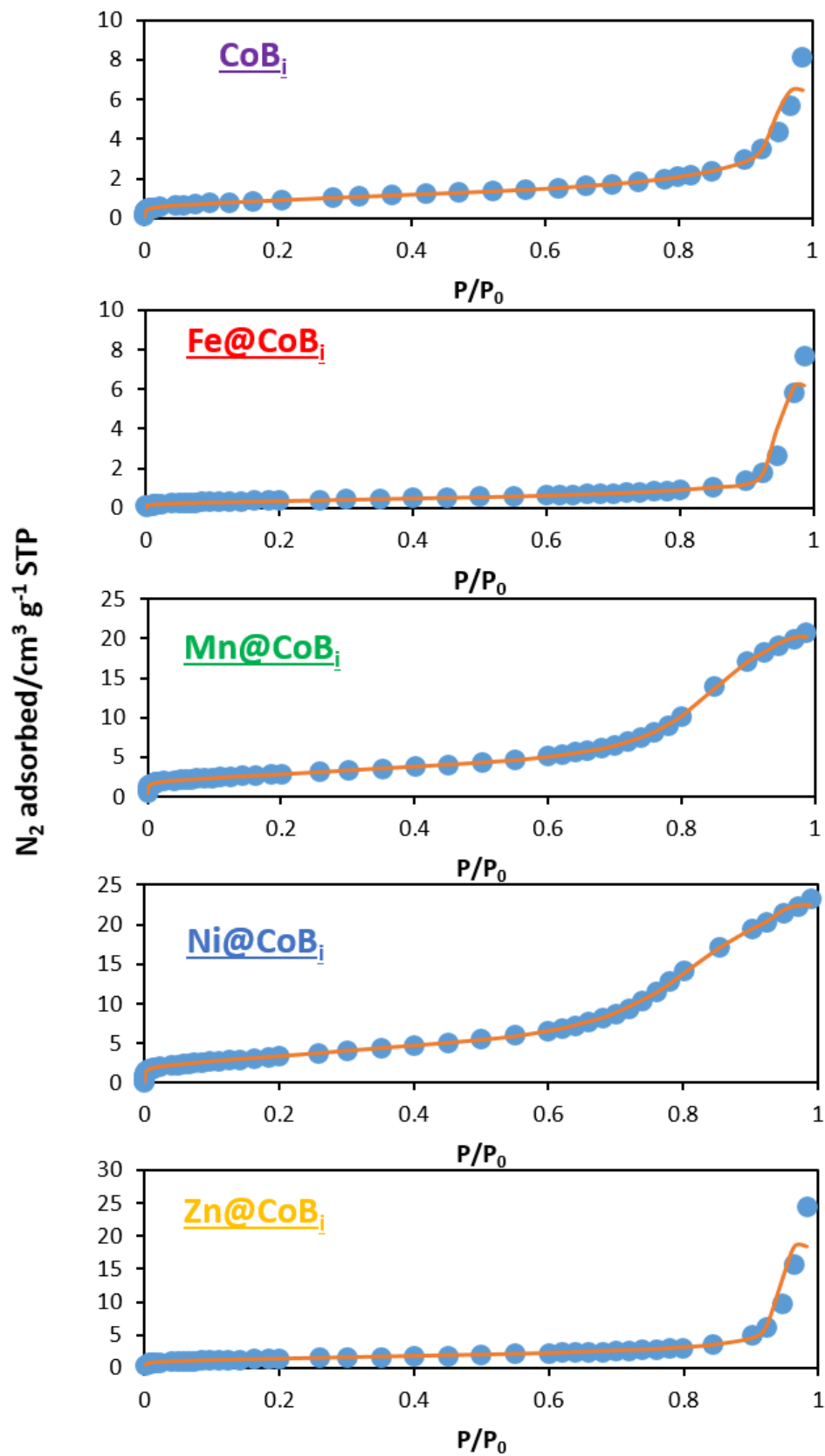


Figure S9: From top to bottom:  $N_2$  adsorption isotherms of  $\text{CoB}_i$ ,  $\text{Fe@CoB}_i$ ,  $\text{Mn@CoB}_i$ ,  $\text{Ni@CoB}_i$  and  $\text{Zn@CoB}_i$

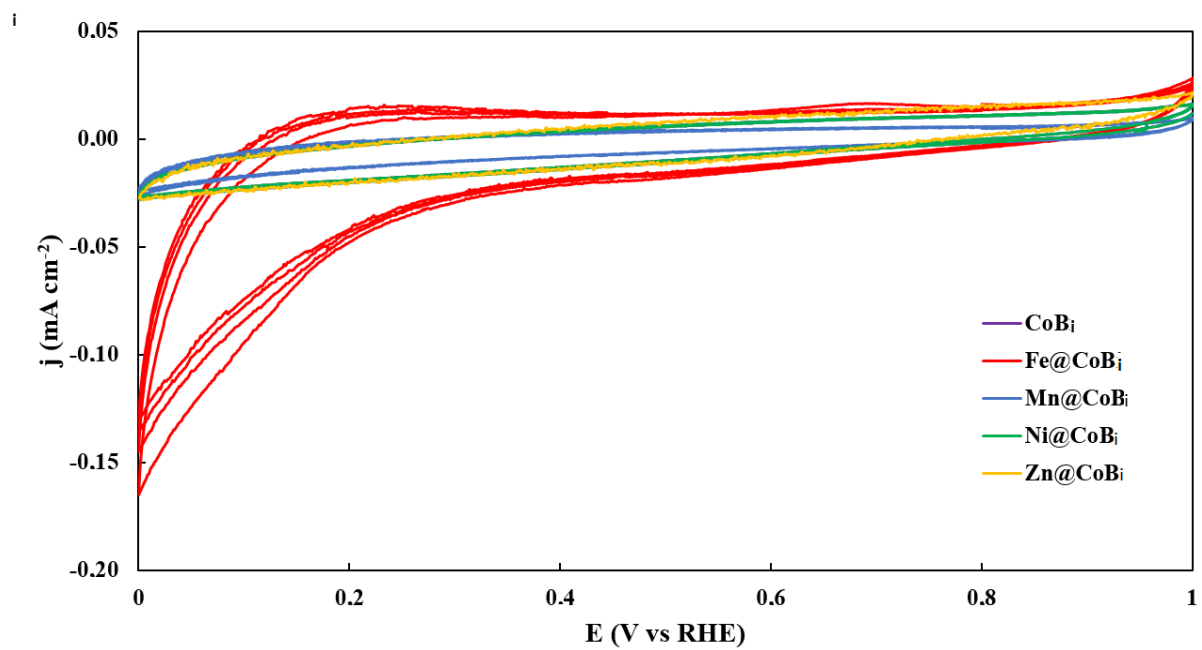


Figure S10: Cyclic voltammetry (CV) curves of CoBi, Fe@CoBi, Mn@CoBi, Ni@CoBi and Zn@CoBi in KOH 1M.

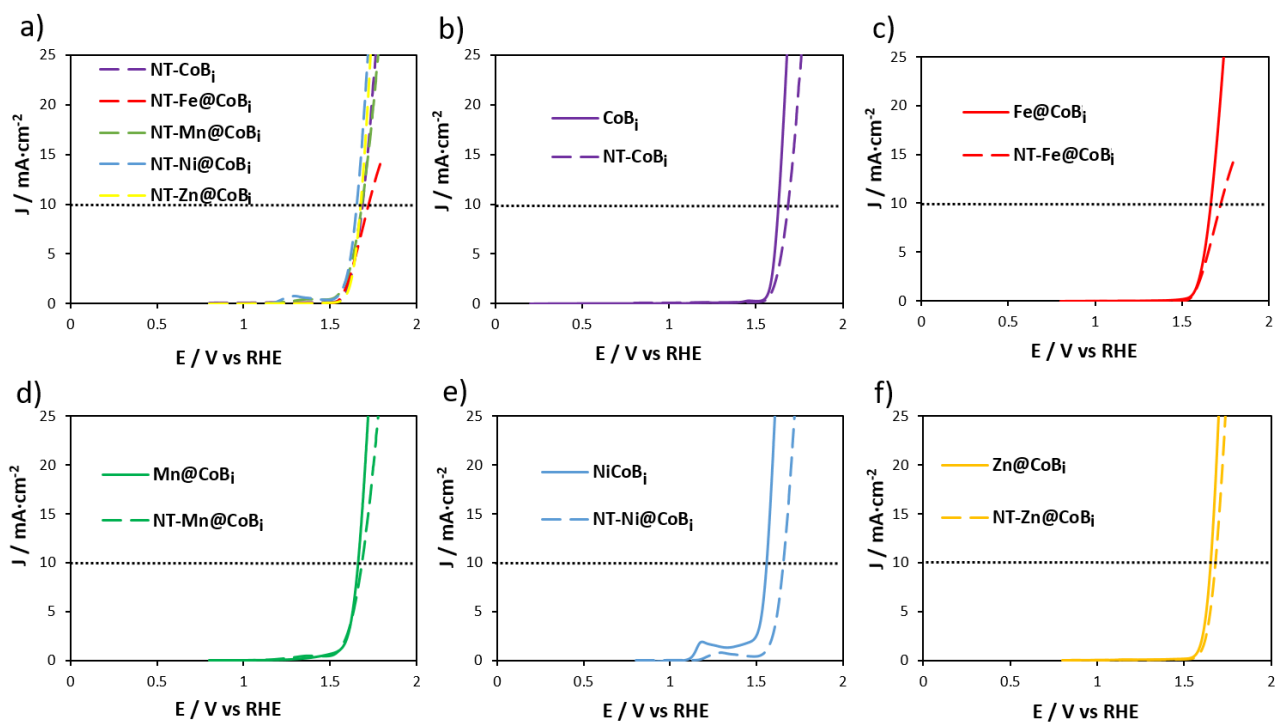


Figure S11: (a) LSV curves of all non-treated materials for OER in 1 M KOH; LSV curves of (b) CoB<sub>1</sub> and NT-CoB<sub>1</sub>, (c), Fe@CoB<sub>1</sub> and NT-Fe@CoB<sub>1</sub>; (d), Mn@CoB<sub>1</sub> and NT-Mn@CoB<sub>1</sub>; (e), Ni@CoB<sub>1</sub> and NT-Ni@CoB<sub>1</sub>; and (f) Zn@CoB<sub>1</sub> and NT-Zn@CoB<sub>1</sub> electrocatalysts.

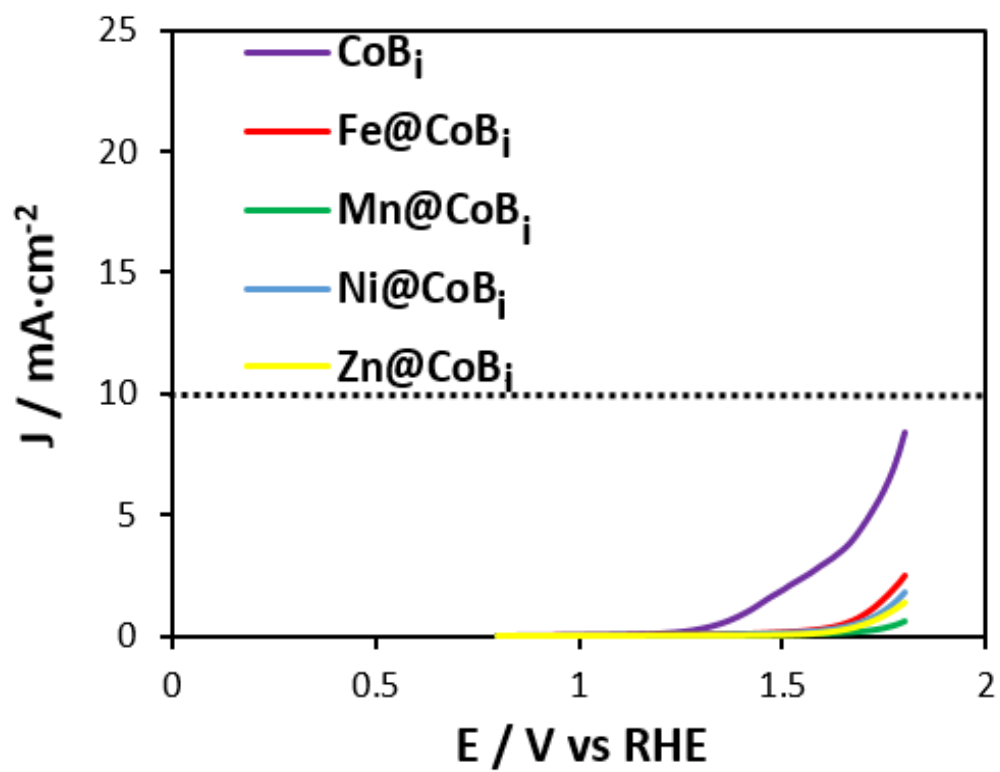


Figure S12: LSV curves of all materials for OER in 1 M Na<sub>2</sub>SO<sub>4</sub>.

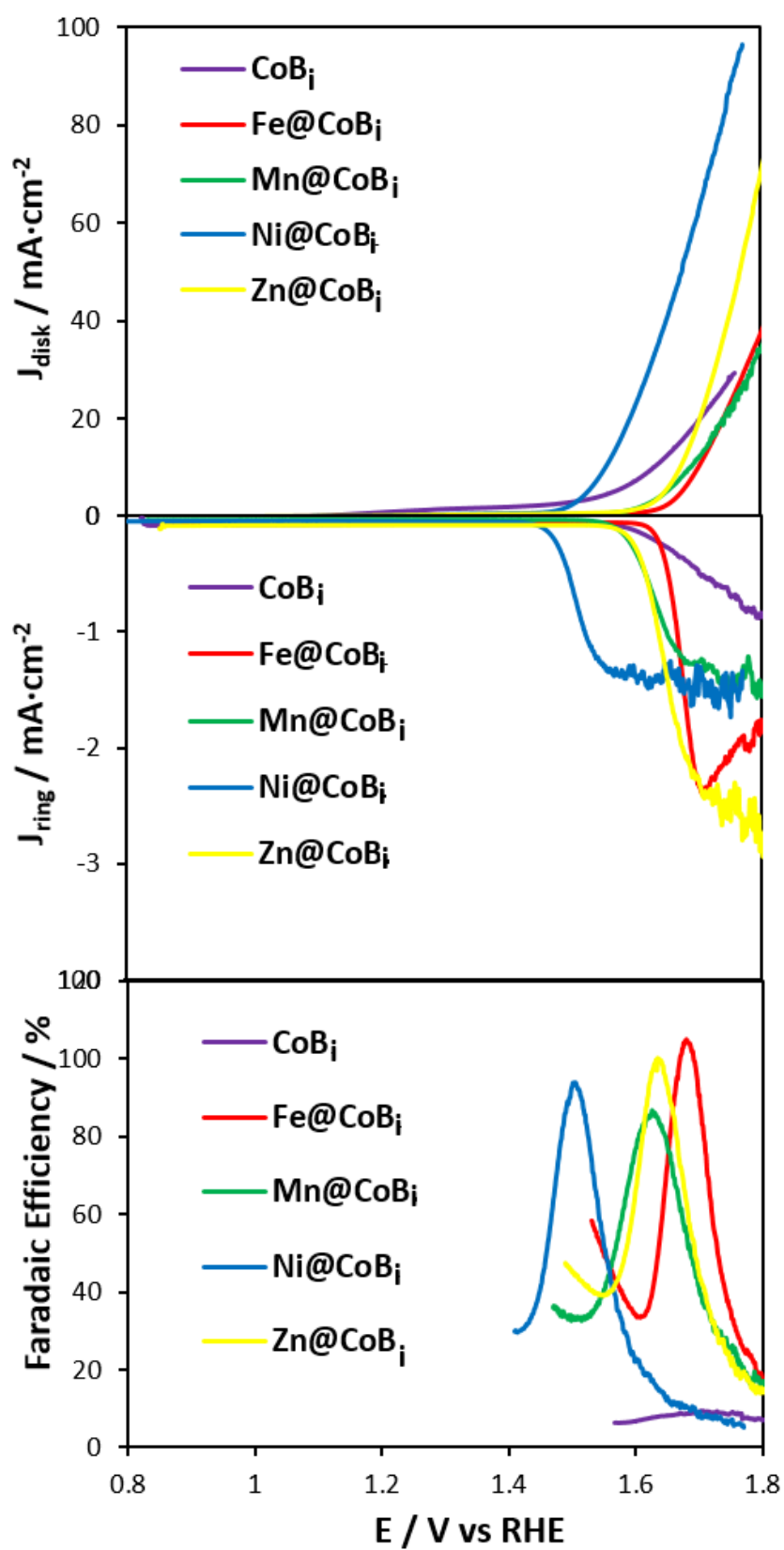


Figure S13: LSV curves of all M@CoB<sub>5</sub> catalysts for OER in 1M KOH: (a) of the disk; and (b) of the Pt ring. (c) Oxygen faradaic efficiency.

<b>Sample</b>	<b>E<sub>OER</sub> / V</b>	<b>Overpotential / V</b>	<b>Reference</b>
<b>CoBi</b>	1.63	0.40	This work
<b>Ni@CoBi</b>	1.56	0.33	This work
Co-Fe-B <sub>i</sub> /non-supported	1.64	0.41	[S <sup>1</sup> ]
Co-Fe-B <sub>i</sub> /Ni-foam	1.54	0.31	[S <sup>1</sup> ]
Co-B <sub>i</sub> /Ni-foam	1.59	0.36	[S <sup>1</sup> ]
Fe-B <sub>i</sub> /Ni-foam	1.65	0.42	[S <sup>1</sup> ]
Co-B <sub>i</sub> /CC	1.65	0.42	[S <sup>2</sup> ]
Ni-Co-B <sub>i</sub> /CC	1.62	0.39	[S <sup>2</sup> ]
NCBO/RGO	1.55	0.32	[S <sup>3</sup> ]
Co-B@Co-B <sub>i</sub>	1.52	0.29	[S <sup>4</sup> ]
Ni-B@Ni-B <sub>i</sub>	1.54	0.31	[S <sup>4</sup> ]
Co-B <sub>i</sub> NS/G	1.53	0.30	[S <sup>3</sup> ]
Co-B <sub>i</sub>	1.58	0.35	[S <sup>5</sup> ]
<b>RuO<sub>2</sub></b>	1.51	0.28	This work

Table S1: Comparison of the results obtained for the catalytic activity in OER of the materials synthesized in this work with similar materials found in the literature.

## References

- S<sup>1</sup> U. P. Suryawanshi, M. P. Suryawanshi, U. V. Ghorpade, S. W. Shin, J. Kim and J. H. Kim, *Appl. Surf. Sci.*, 2019, **495**, 143462.
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- S<sup>4</sup> T. Tan, P. Han, H. Cong, G. Cheng and W. Luo, *ACS Sustain. Chem. Eng.*, 2019, **7**, 5620–5625.
- S<sup>5</sup> P. Chen, K. Xu, T. Zhou, Y. Tong, J. Wu, H. Cheng, X. Lu, H. Ding, C. Wu and Y. Xie, *Angew. Chemie - Int. Ed.*, 2016, **55**, 2488–2492.