Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Effect of Cobalt Doping on Photocatalytic Water Splitting Activity of NiTi-Layered Double Hydroxide

Sara Samuei [a], Sina Sadigh Akbari [a], Emine Ülker[b], Ferdi Karadas*[a,c]

a. Department of Chemistry, Faculty of Science, Bilkent University, Ankara 06800, Turkey. E-mail: karadas@fen.bilkent.edu.tr .

b. Department of Chemistry, Faculty of Arts & Science, Recep Tayyip Erdogan University, Rize, Turkey.

c.UNAM – National Nanotechnology Research Center, Institute of Materials Science

and Nanotechnology, Bilkent University, Ankara 06800, Turkey.

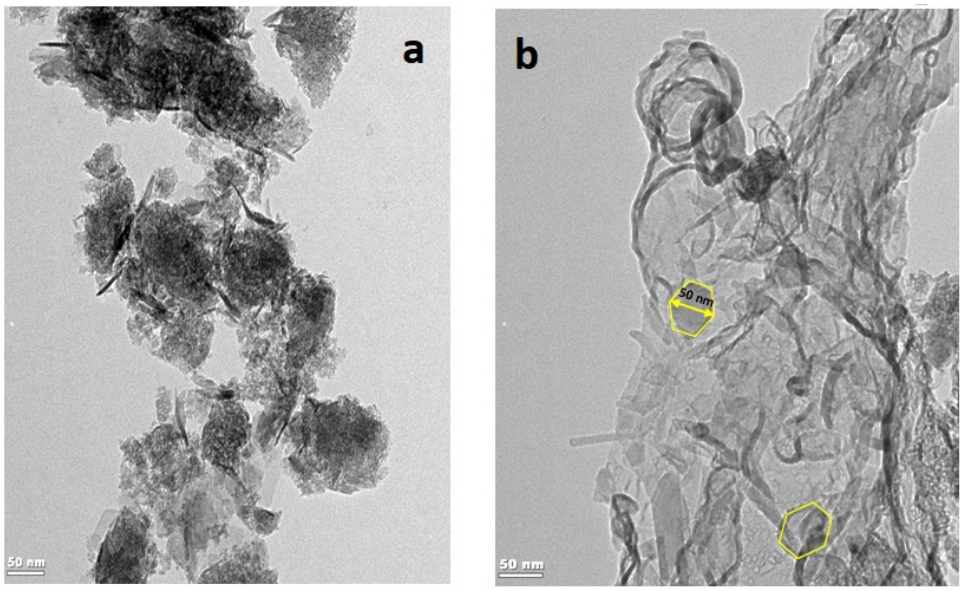


Fig. S1 TEM micrographs of (a) CoNiTi-LDH and (b) NiTi-LDH samples after treatment in butanol.

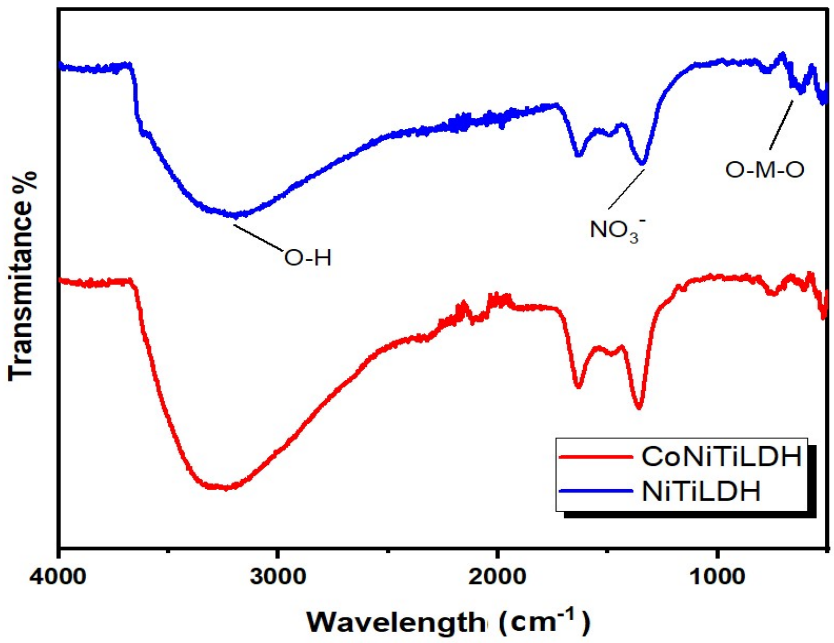


Fig. S2 FT-IR spectra of (a) CoNiTi-LDH and (b) NiTi-LDH samples.

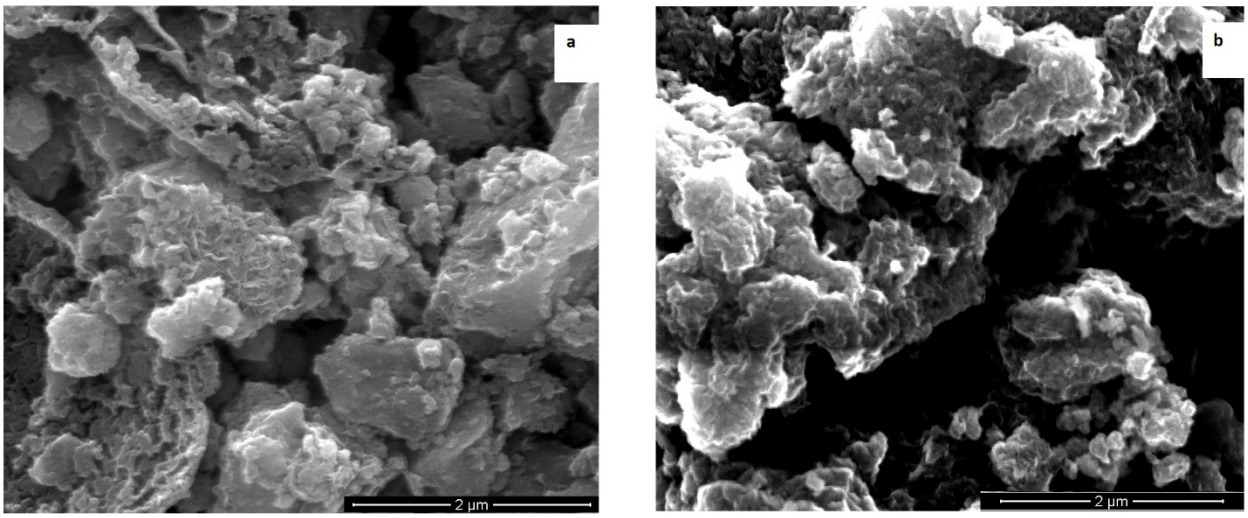
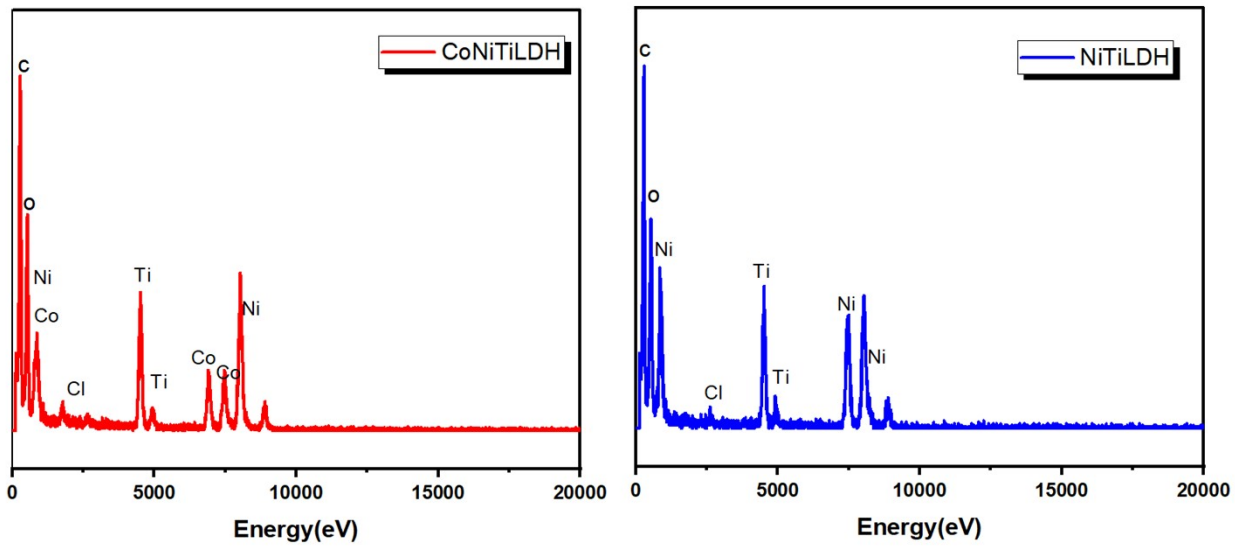


Fig. S3. SEM micrographs of (a) CoNiTi-LDH and (b) NiTi-LDH samples.



Atomic % by Element

Filename	C K	O K	TiK	CoK	NiK
genspc.spc	13.95	76.34	5.38	1.28	1.30

Atomic % by Element

Filename	O K	TiK	NiK
genspc.spc	68.35	14.67	16.97

Fig. S4 SEM-EDS analysis and the atomic ratio of CoNiTi-LDH and NiTi-LDH samples.

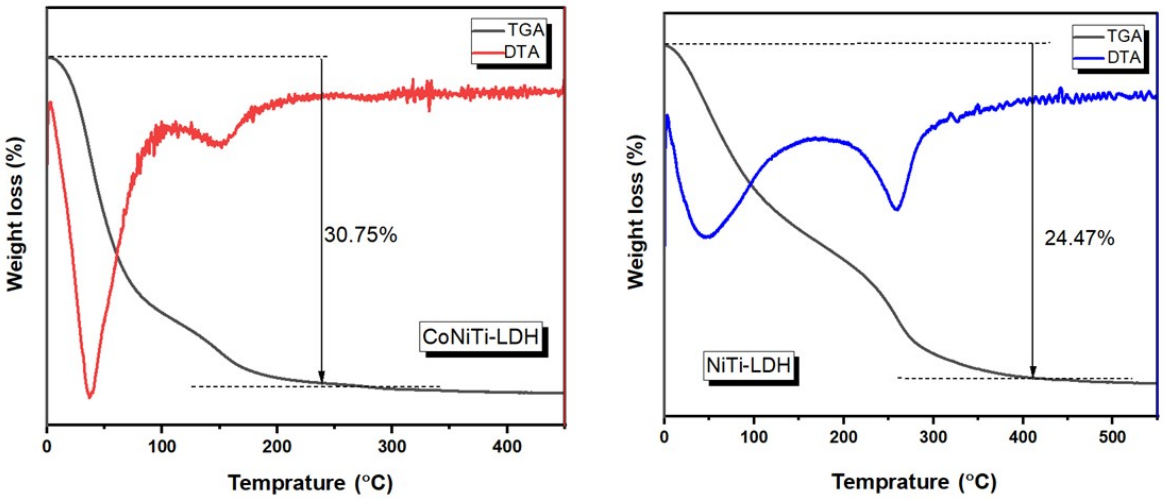


Fig. S5 TGA and DTA patterns of (a) CoNiTi-LDH and (b) NiTi-LDH samples.

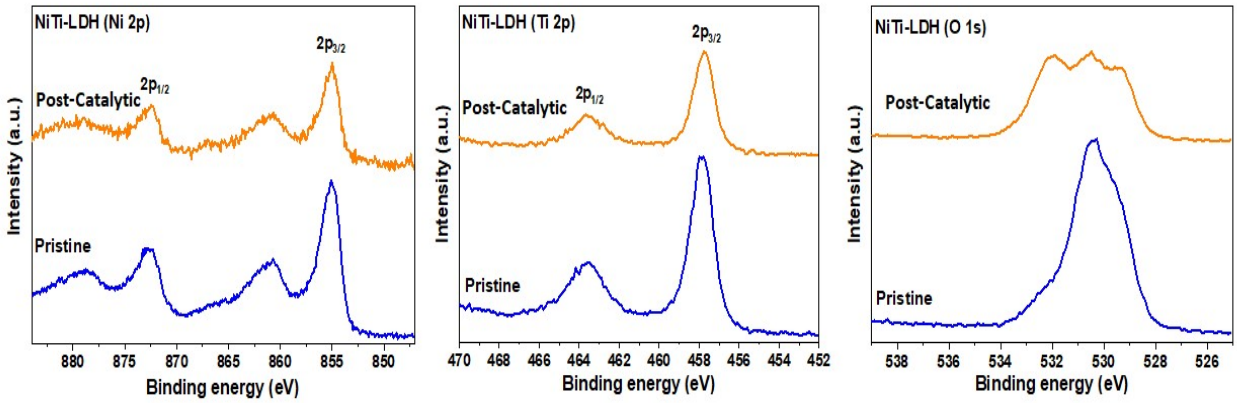


Fig. S6 XPS spectra of NiTi-LDH for pristine and post-catalytic samples.

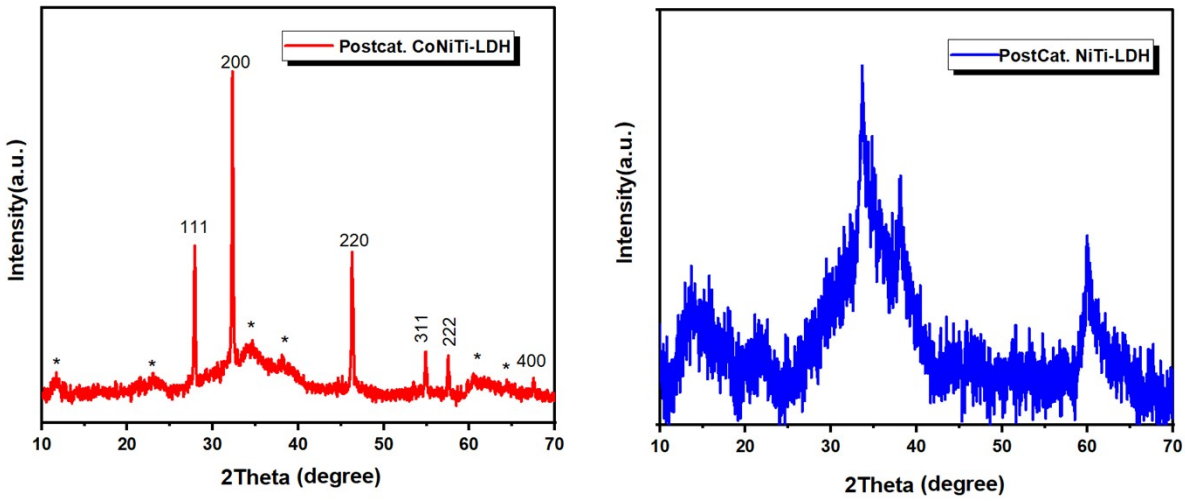


Fig. S7 XRD patterns of post-catalyst CoNiTi-LDH and NiTi-LDH after four cycles.

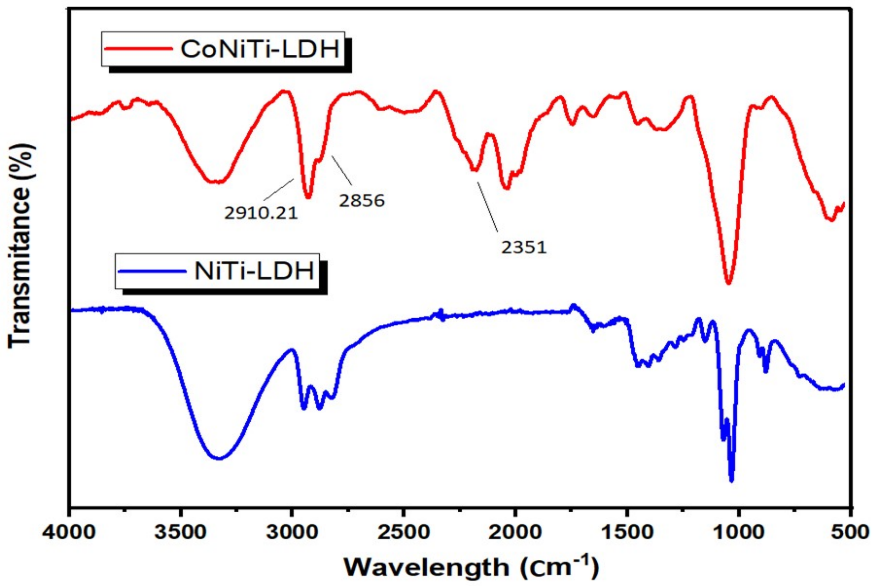


Fig. S8 FT-IR spectra of post catalyst (a) CoNiTi-LDH, (b) NiTi-LDH.

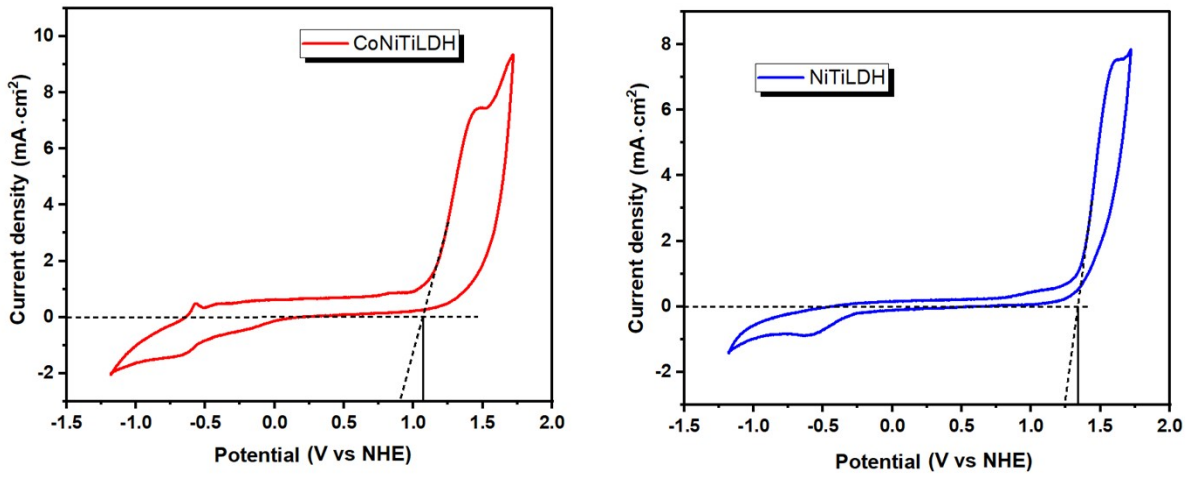


Fig. S9 Cyclic voltammogram curves of CoNiTi-LDH and NiTi-LDH samples.

Table.S1 The reported O_2 and H_2 evolution rate of some LDH Catalyst compared with this study.

Photocatalyst	**Synthesis method**	**Amount of catalyst**	**Incident light**	**Solution/ Sacrificial agent**	**O_2 evolved µmol· g^{-1} h^{-1}**	**H_2 evolved µmol· g^{-1} h^{-1}**	**Reference**
TiO_2	Hydrothermal	200	>400 nm	$H_2O/AgNO_3$	<10	-	48,49
ZnTi-LDH	Co-precipitation	45	>400 nm	$H_2O/AgNO_3$	268.3	-	54
NiTi-LDH	Co-precipitation	200	700-400 nm	$H_2O/AgNO_3$	50	-	55

CuTi-LDH	Co-precipitation	200	700-400 nm	$H_2O/AgNO_3$	30	-	55
ZnCr-LDH/TiO_2	Layer by layer	10	>420 nm	$H_2O/AgNO_3$	1180	-	55
NiTi-LDH	Reverse micro emulsion	50	>400 nm	$H_2O/AgNO_3$	2148	-	30
NiTi-LDH	Co-precipitation	50	>400 nm	$H_2O/AgNO_3$	267	-	30
g-C_3N_4/NiFe LDH	Weight impregnation	30	>420 nm	H_2O/Methanol	-	1488 (2 h^{-1})	53
FeMgAl-LDH	Co-precipitation	20	>420 nm	CH_3OH/None	-	493	52
CdS/ZnCr-LDH	Exfoliation-restacking	100	>420 nm	None/Na_2SO_3+Na_2S		374	51
Au/ZnAl-LDH	Memory effect	100	whole range	H_2O/Methanol	-	132	50
NiTi-LDH	Co-precipitation	10	>420 nm	$H_2O/AgNO_3$ H2O/Methanol	161	2	This work
CoNiTi-LDH	Co-precipitation	10	>420 nm	$H_2O/AgNO_3$ H2O/Methanol	366	3.4	This work

30 Y. Zhao, P. Chen, B. Zhang,] Dang, S. Su, S. Zhang, L. Tian, J. Lu, Z. Li, X. Cao, B. Wang, M. Wei, D. G. Evans and X. Duan, *weimin.buct.edu.cn*, , DOI:10.1002/chem.201201065.

48 J. Tao, Q. Cuan, X. Q. Gong and M. Batzill, *J. Phys. Chem. C*, 2012, **116**, 20438–20446.

49 A. Naldoni, M. Allieta, S. Santangelo, M. Marelli, F. Fabbri, S. Cappelli, C. L. Bianchi, R. Psaro and V. Dal Santo, *J. Am. Chem. Soc.*, 2012, **134**, 7600–7603.

50 F. Sastre, M. Oteri, A. Corma and H. García, *Energy Environ. Sci.*, 2013, **6**, 2211–2215.

51 G. Zhang, B. Lin, W. Yang, S. Jiang, Q. Yao, Y. Chen and B. Gao, *RSC Adv.*, 2014, **5**, 5823–5829.

52 K. Parida, M. Satpathy and L. Mohapatra, *J. Mater. Chem.*, 2012, **22**, 7350–7357.

53 S. Nayak, L. Mohapatra and K. Parida, *J. Mater. Chem. A*, 2015, **3**, 18622–18635.
54 K. Qi, S. Y. Liu and M. Qiu, *Chinese J. Catal.*, 2018, **39**, 867–875.
55 F. Zuo, L. Wang, T. Wu, Z. Zhang, D. Borchardt and P. Feng, *J. Am. Chem. Soc.*, 2010, **132**, 11856–11857.