Electronic Supplementary Material (ESI) for Materials Advances.

Supporting Information:

Bifunctional Intermetallic PdZn Nanoparticle-Loaded Deficient TiO_2 Nanosheet Electrocatalyst for Electrochemical Water Splitting

Keerti M. Naik*[a], Kanaru Hashisake,[a] Eiji Higuchi,[a] Hiroshi Inoue[a]

Department of Applied Chemistry, Graduate School of Engineering, Osaka Metropolitan University (formerly Osaka Prefecture University), Sakai, Osaka 599-8531, Japan.

***Corresponding authors:**

E-mail address:keertiraman@gmail.com(K.M. Naik);

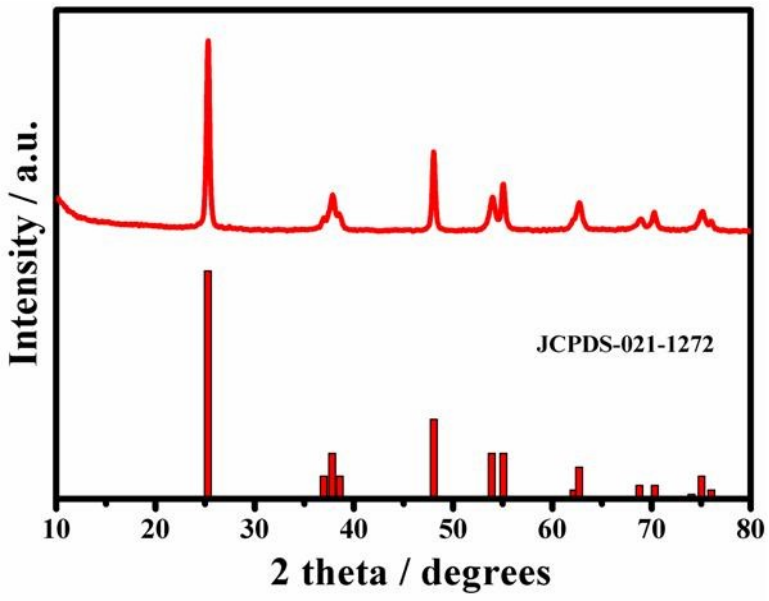

Fig. S1. Experimental XRD pattern of TiO_2 NSs and the standard XRD pattern of a-TiO_2 (JCPDS-021-1272).

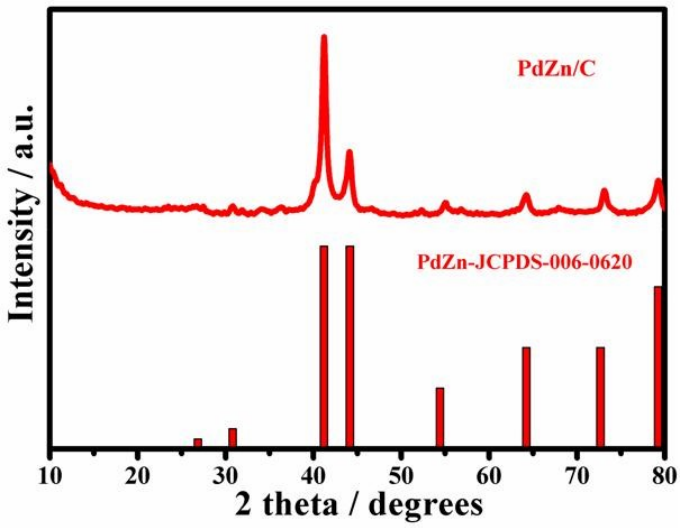

Fig. S2. XRD pattern of PdZn/C and the standard XRD pattern of PdZn (JCPDS-006-0620).

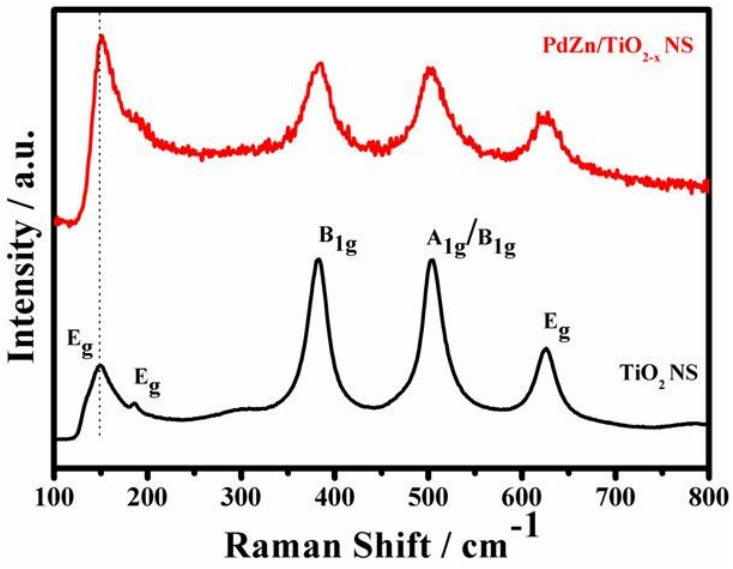

Fig. S3. Raman spectra of TiO_2 NSs and PdZn/TiO_{2-x} NSs.

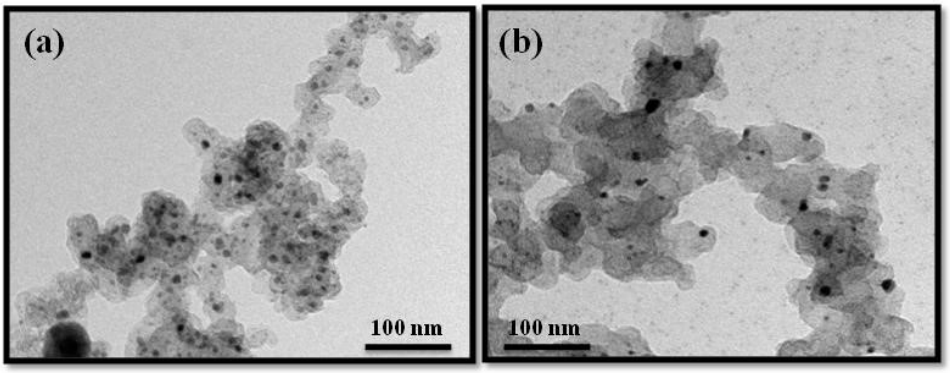

Fig. S4. TEM images of (a) PdZn/C and (b) Pt/C.

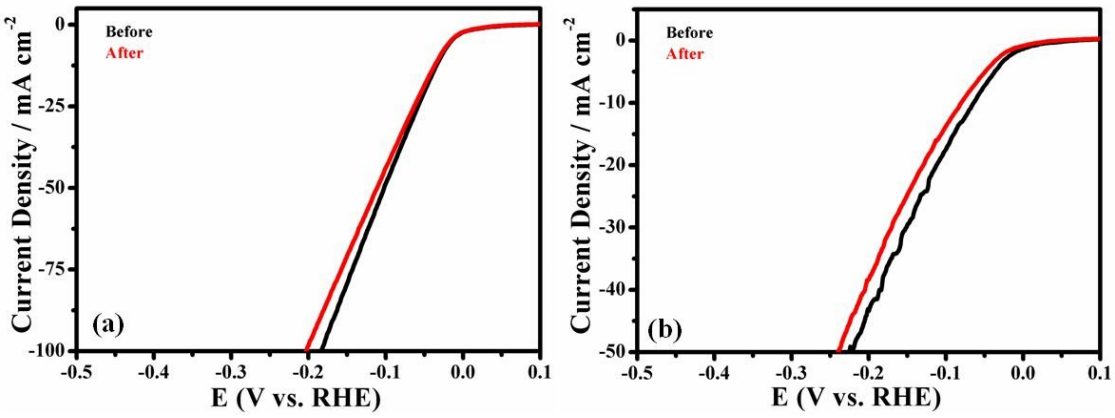

Fig. S5. (a) Hydrodynamic voltammogramms at 1600 rpm of PdZn/TiO_{2-x} NSs before and after potentiostatic HER measurement at -0.1 V vs. RHE in Ar-saturated (a) 0.5 M H_2SO_4 and (b) 1 M KOH solutions at 25 ºC.

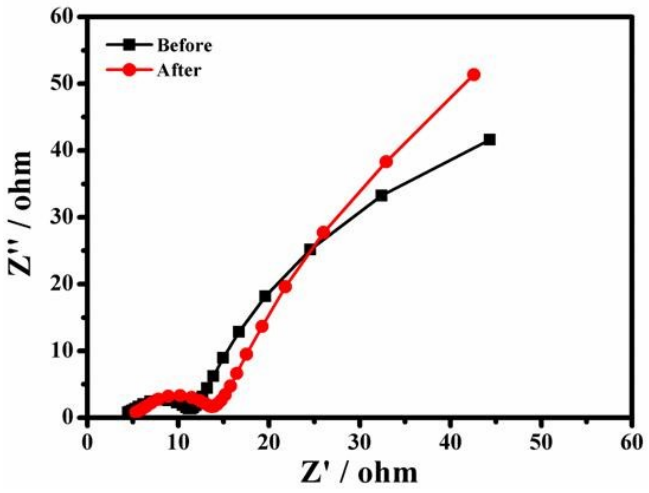

Fig. S6. Nyquist plots of PdZn/TiO_{2-x} NSs at -0.05 V vs. RHE before and after potentiostatic HER measurement in an Ar-saturated 0.5 M H_2SO_4 solution.

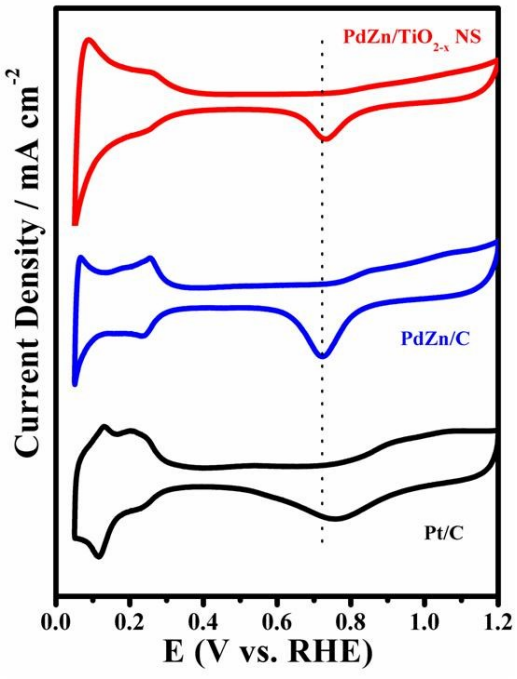

Fig. S7. Cyclic voltammogramms of $PdZn/TiO_{2-x}$ NS, PdZn/C and Pt/C in Ar-saturated 0.5 M H_2SO_4 electrolyte at a scan rate of 50 mV s^{-1}.

Table S1. Comparison of the HER and OER activity for the prepared $PdZn/TiO_{2-x}$ NS with the reported active electrocatalysts in alkaline solution.

Catalyst	HER Overpotential (mV vs. RHE)	Tafel slope (mV Dec^{-1})	OER Overpotential (mV vs. RHE)	Tafel slope (mV Dec^{-1})	References
$TiO_2@Co_9S_8$	139	65	240	55	[1]
$NiCo_2O_4(2:1)/TiO_2$	185	120	309	55	[2]
$NiCo_2O_4/Ti_4O_7$	398	64	-	-	[3]
$CoSCo(OH)_2@aMoS_{2+x}/NF$	143	68	380	68	[4]
$Ni_{0.9}Fe_{0.1}/NC$	231	111	330	45	[5]
$Ti_3C_2@mNiCoP$	127	103	237	104	[6]
$Co_{3.2}Fe_{0.8}N/MNC-100$	504.2	250.83	350	131	[7]
$PdP_2@CB$	35.4	42.1	270	78.6	[8]
$PdZn/TiO_{2-x}$ NS	**64**	**68**	**460**	**115**	**Present work**

Notes and References

1 S. Deng, Y. Zhong, Y. Zeng, Y. Wang, X. Wang, X. Lu, X. Xia, J. Tu, *Adv. Sci.,* 2018, **5**, 1700772.

2 R. Vadakkekara, R. Illathvalappil, S. Kurungot*, ChemElectroChem* 2018, **5**, 4000-4007.

3 Z. Zheng, W. Geng, Y. Wang, Y. Huang, T. Qi, *Int. J. Hydrog. Energy,* 2017, **42**, 119-124.

4 T. Yoon, K. S. Kim, *Adv. Funct. Mater.,* 2016, **26**, 7386-7393.

5 X. Zhang, H. Xu, X. Li, Y. Li, T. Yang, Y. Liang, *ACS Catal.,* 2016, **6**, 580-588.

6 Q. Yue, J. Sun, S. Chen, Y. Zhou, H. Li, Y. Chen, R. Zhang, G. Wei, Y. Kang, *ACS Appl. Mater. Interfaces,* 2020, **12**, 18570-18577.

7 K. Zhang, W. Mai, J. Li, G. Li, L. Tian, W. Hu, *ACS Appl. Nano Mater.,* 2019, **2**, 5931-5941.

8 F. Luo, Q. Zhang, X. Yu, S. Xiao, Y. Ling, H. Hu, L. Guo, Z. Yang, L. Huang, W. Cai, H. Cheng, Angew. Chem., 2018, **130**, 15078 -15083.