SUPPLEMENTARY INFORMATION

From Doping to Composites: Zirconia (ZrO_2) Modified Hematite Photoanodes for Water Splitting

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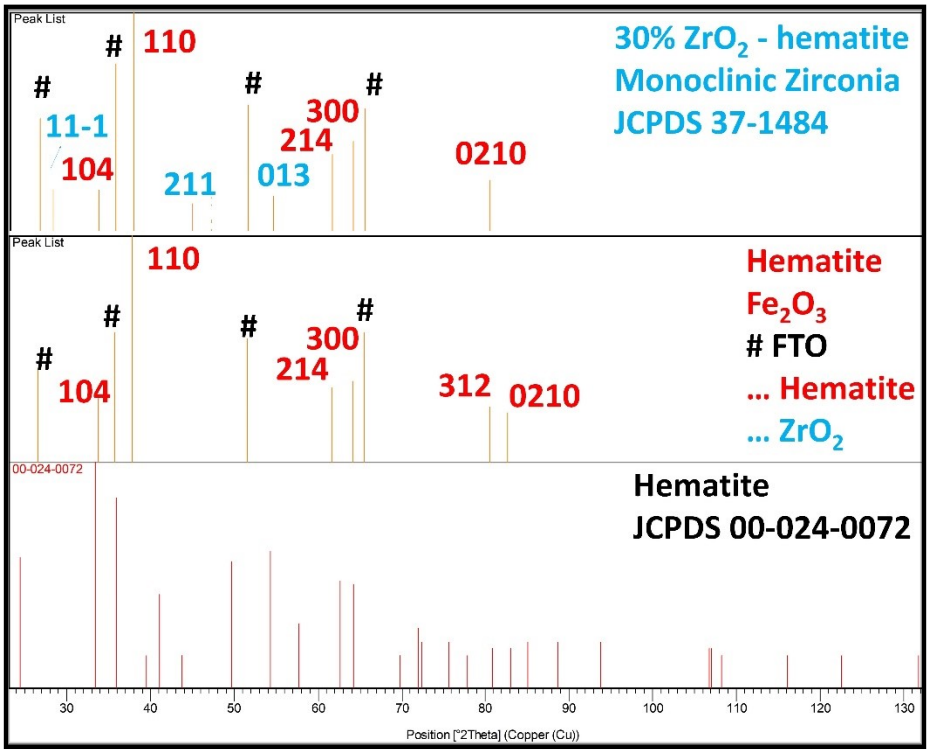


Fig S1(a) XRD line pattern for hematite as taken from the JCPDS (00-024-0072) ,experimental XRD patterns taken for a sample of pristine hematite and a sample of 30 wt.% zirconia/hematite deposited on FTO, respectively.

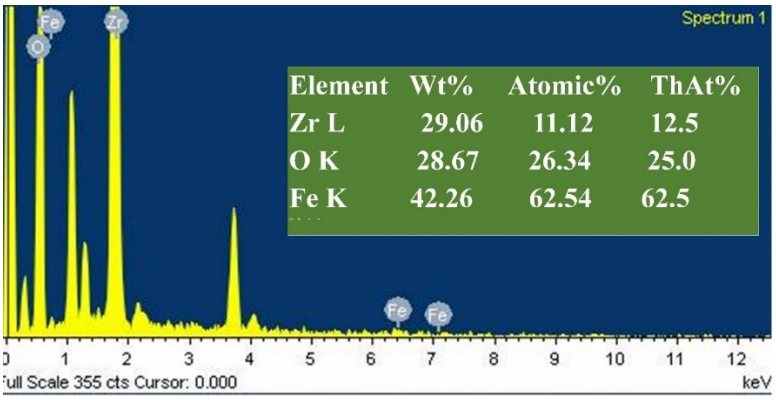
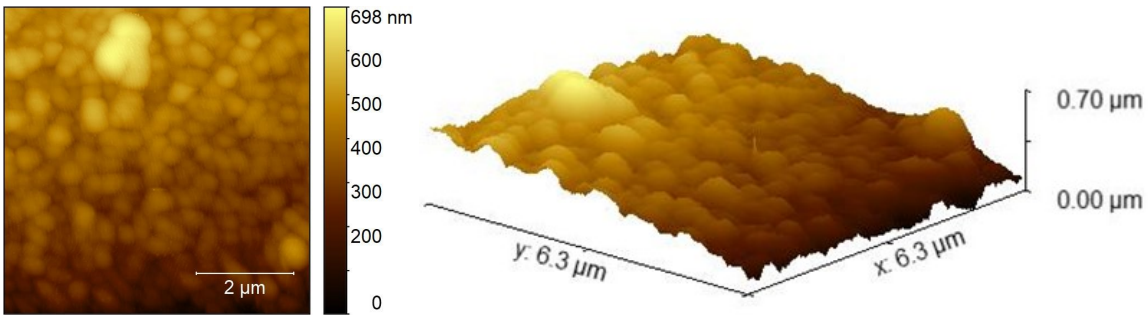


Fig. S2. EDX spectrum for a sample of 30 wt% zirconia added hematite. The corresponding quantitative analysis is provided in the inset table.



Roughness (Ra): 6.076 nm

Root mean square roughness (RMS): 7.641nm

Fig.S3. AFM images of ZrO_2/α-Fe_2O_3 (a) 2D and (b) 3D showing topography of the films and an estimation of the surface roughness.

Table S1. Average crystallite size, from XRD data using Scherrer formula, of Zirconia added- α-Fe_2O_3 films prepared by AACVD method.

Amount of added ZrO_2 / wt.%	**Crystallite size / nm**
2	7
5	13
10	17
20	42
30	14
40	11

Table S2 Direct optical band gaps of zirconia added hematite as a function of composition as calculated from analysis of DR-UV-VIS data from K-M plots

Amount of added zirconia/wt%	Band gap/eV
0 (pure Fe_2O_3)	2.03
2	2.02
5	1.99
10	1.85
20	2.07
30	2.14
40	1.96
100 (*m*- ZrO_2)	3.6

Table S3.% IPCE vs wave length and potential of 30% zirconia added hematite.

Photoanode	**% IPCE vs. Wavelength**	**% IPCE vs. Potential**
Hematite	18%@265 nm 18%@285 nm	0.53%@0.23 V
30 wt.% ZrO_2/Fe_2O_3	48% @ 265 nm 58%@ 285 nm	11%@0.23 V

Table S4. Photocurrents and onset potentials (E_{onset}) for ZrO_2/hematite as a function of composition.

Amount of added ZrO_2 / wt.%	E_{onset} / V	Photocurrent density mA/cm^2 @1.23V
0	0.86	1.23
2	0.95	0.21
5	0.78	0.48
10	0.78	0.63
20	0.74	2.12
30	0.73	3.06
40	1.06	1.03

Table S5. Electron lifetimes for hematite as compared to 30 wt.% zirconia/hematite

Amount of added ZrO_2 / wt.%	Electron lifetime / ms
0	0.175
30	1.690

Table S6. Amounts of hydrogen and oxygen evolved (as determined by GC) as a function of time for pristine hematite and 30 wt.% zirconia/hematite

Time / h	H_2 evolved / µmol cm^{-2}		O_2 evolved / µmol cm^{-2}	
	α-Fe_2O_3	30 wt.% ZrO_2/α-Fe_2O_3	α-Fe_2O_3	30 wt.% ZrO_2/α-Fe_2O_3
1	0	0.27	0.721	4.49
2	0.45	0.47	0.956	5.16
3	0.121	0.69	0.977	6.78
4	0.215	0.74	1.063	7.89
5	0.328	0.94	1.174	9.39
6	0.402	1.02	1.23	11.04