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

Supporting Information

The effect of $Rh^{\delta+}$ incorporation in $SrTiO_3$ on the active oxidation state of co-catalytic Pt nanoparticles in overall water splitting

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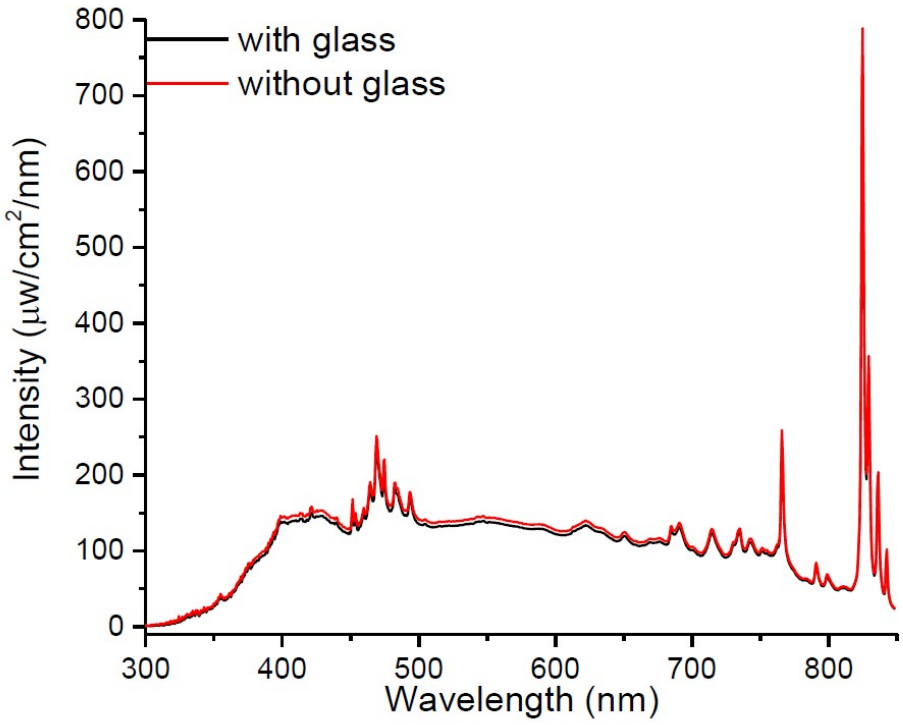


FigureSI1: Emission spectrum of the applied light source. The intensity incident on the reactor window from 300-900 nm amounted to 59 mW/cm^2, and from 300-400 nm to 0.9 mW/cm^2.

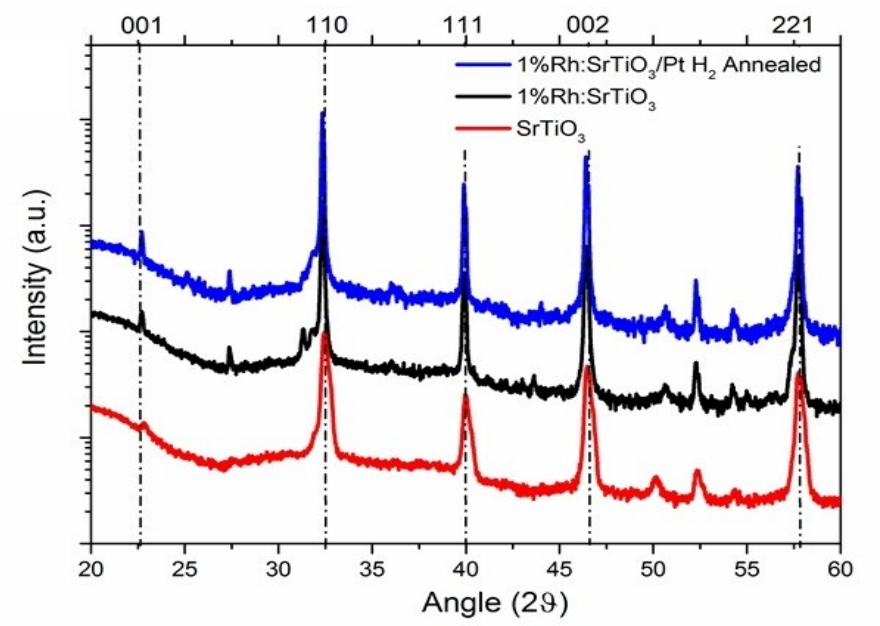
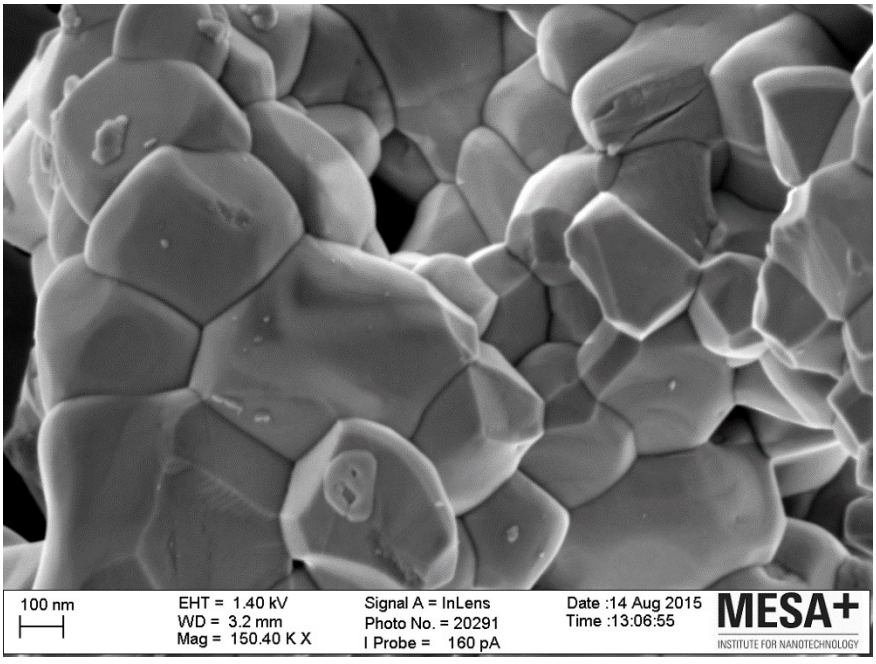


Figure SI2: XRD patterns of the as-synthesized $SrTiO_3$ (red) and 1%Rh:$SrTiO_3$ (black). For comparison, the XRD pattern of 1%Rh:$SrTiO_3$ (black) after photodeposition of Pt, and treatment at 700 ºC in hydrogen atmosphere is shown.



FigureSI3: SEM image of Rh:$SrTiO_3$.

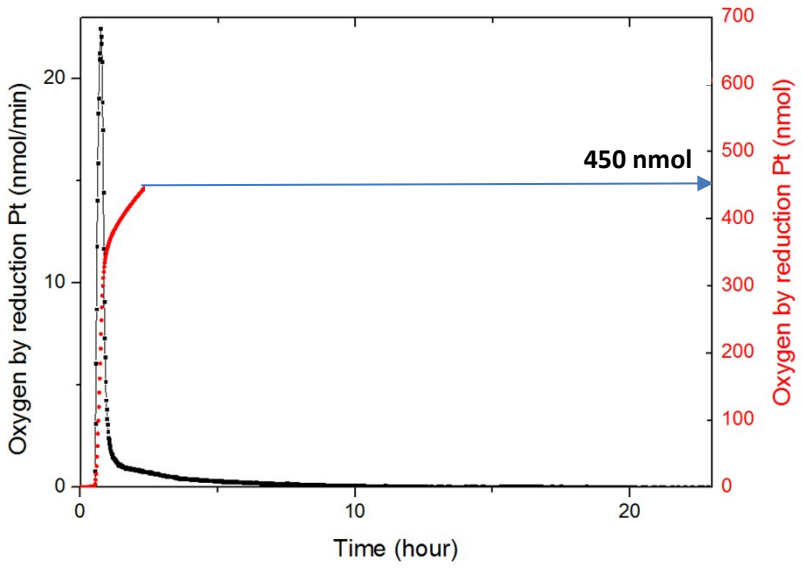
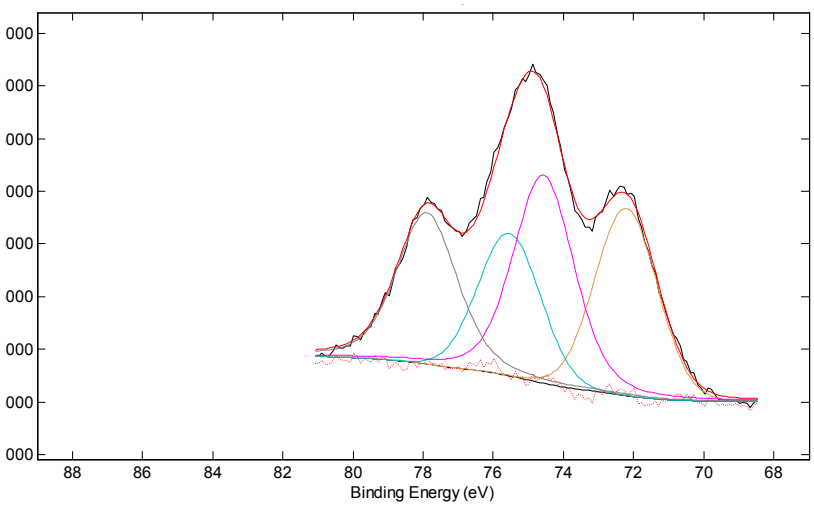
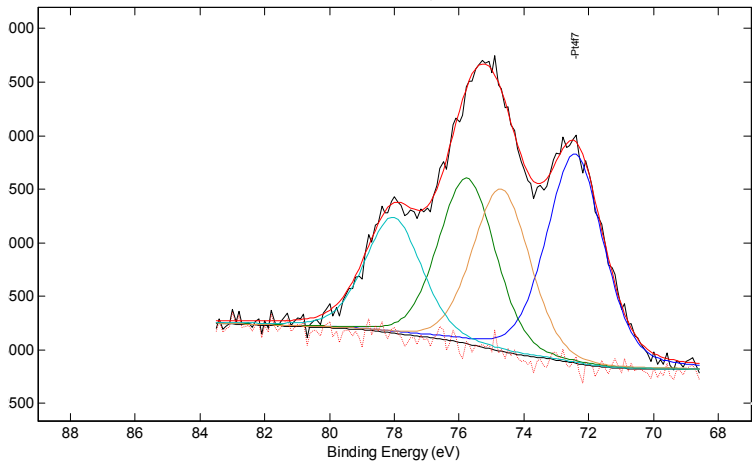


Figure SI4: Quantity of oxygen formed in the course of the experiment for $Pt/SrTiO_3$, above the stoichiometric quantity expected on the basis of the amount of hydrogen produced. This amounts to 450 nmol O_2. Compared to the quantity of Pt present in the reactor (estimated to be 1.3 µmol), a ration of Pt(II)O over Pt can be calculated of 0.7, similar to the ratio determined from the XPS spectra (0.55 on the basis of area percentages).



Spec	Band	Pos	PosSep	B_FWHM	FWHM	Height	%Gauss	Area	%Area	ChiSquared
1	1	72.21	0.00	2.09	2.09	3559	97	8038	25.87	0.64
	2	74.57	2.35	2.03	2.03	3955	71	9713	31.27	
	3	75.54	3.33	2.09	2.09	2708	100	6028	19.41	
	4	77.90	5.68	2.03	2.03	2876	63	7285	23.45	

Figure SI5: Deconvoluted XPS spectrum of $Pt/SrTiO_3$ after preparation, including relative area percentages.



Spec	Band	Pos	PosSep	B_FWHM	FWHM	Height	%Gauss	Area	%Area	ChiSquared
1	1	72.42	0.00	2.05	2.05	1954	69	4898	33.02	0.38
	2	74.70	2.28	2.05	2.05	1518	83	3578	24.12	
	3	75.75	3.33	2.05	2.05	1546	81	3673	24.76	
	4	78.03	5.61	2.05	2.05	1083	72	2684	18.09	

Figure SI6: Deconvoluted XPS spectrum of Pt/Rh:$SrTiO_3$ after preparation, including relative area percentages.

C1s	O1s	Ti2p	Cu2p	Sr3d	Pt4f	
0.314	0.733	2.077	4.395	1.992	6.080	RSF
34.940	81.758	254.264	538.032	252.989	783.335	CorrectedRSF
9.31	58.97	11.75	0.53	17.91	1.53	
12.03	57.58	11.18	0.41	17.32	1.47	
10.09	59.17	11.47	0.23	17.40	1.64	
10.33	58.43	11.72	0.46	17.32	1.73	
10.44	58.54	11.53	0.41	17.49	1.59	Mean
1.15	0.71	0.26	0.13	0.29	0.12	Standard Deviation

Figure SI7: Atomic percentages of the elements present in the Pt/$SrTiO_3$ catalyst, showing a mean atomic Pt percentage of 1.59.

Atomic Concentration Table

C1s	O1s	Ti2p	Sr3d	Rh3d	Pt4f	
0.314	0.733	2.077	1.992	5.092	6.080	RSF
34.940	81.758	254.264	252.989	642.250	783.335	CorrectedRSF
7.81	58.02	12.76	19.70	0.80	0.90	
9.73	58.32	12.08	18.59	0.66	0.62	
11.87	56.81	11.98	17.92	0.71	0.72	
8.51	59.00	12.21	18.78	0.76	0.74	
9.48	58.04	12.26	18.75	0.73	0.74	Mean
1.78	0.91	0.35	0.74	0.06	0.11	Standard Deviation

Figure SI8: Atomic percentages of the elements present in the Pt/Rh:$SrTiO_3$ catalyst, showing a mean atomic Pt percentage of 0.74.