Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.
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Supplementary Information

A Unique Octadecahedron $SrTiO_3$ perovskite oxide with nano step-shaped facet structure for enhanced photoredox and hydrogen evolution performance.

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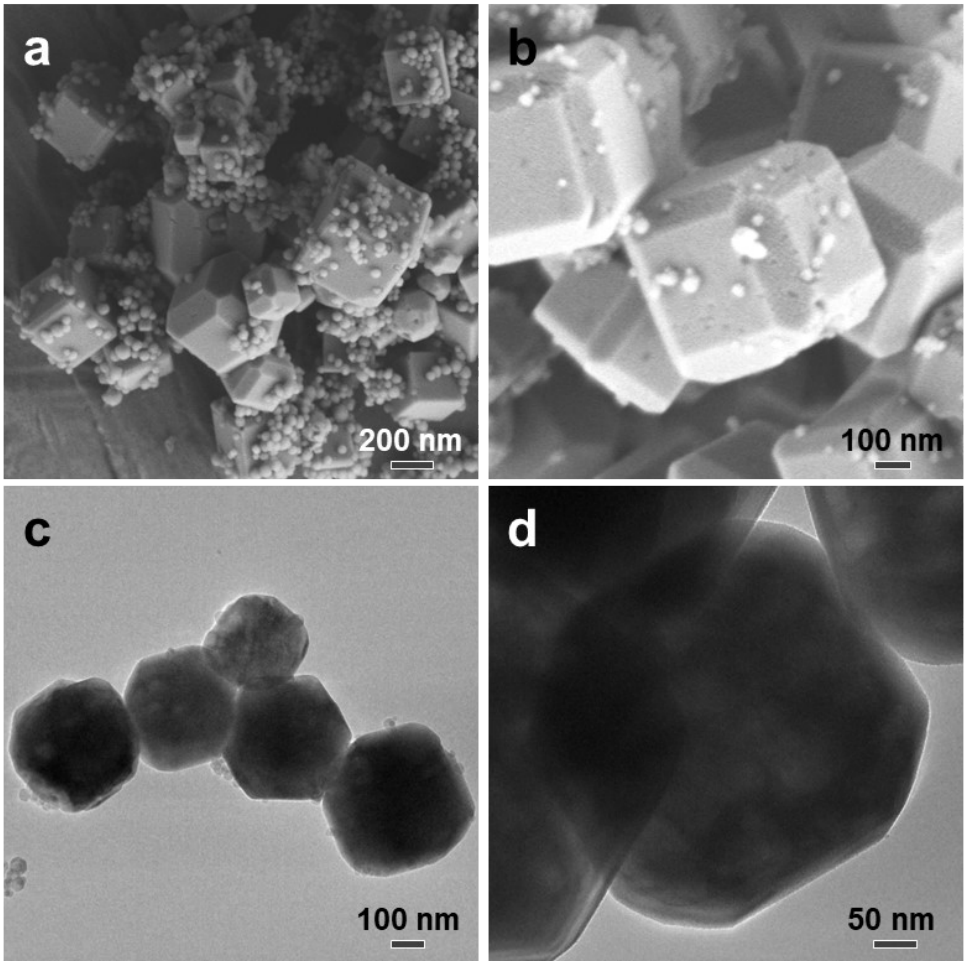

Figure S1.SEM graph (a, b) and TEM graph (c, d) of 18-STO-HM.

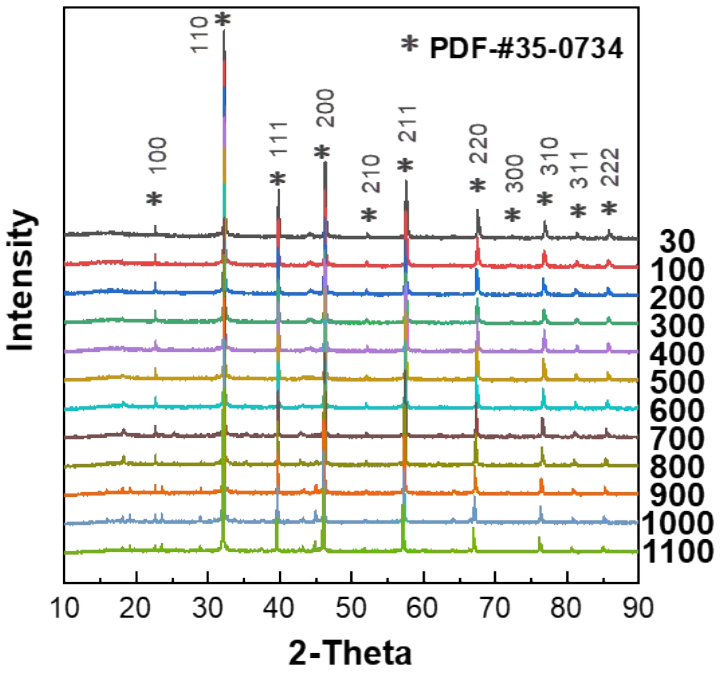

Figure S2. The two-dimensional diagram in-situ XRD pattern solid-state reaction of 18-STO-HM.

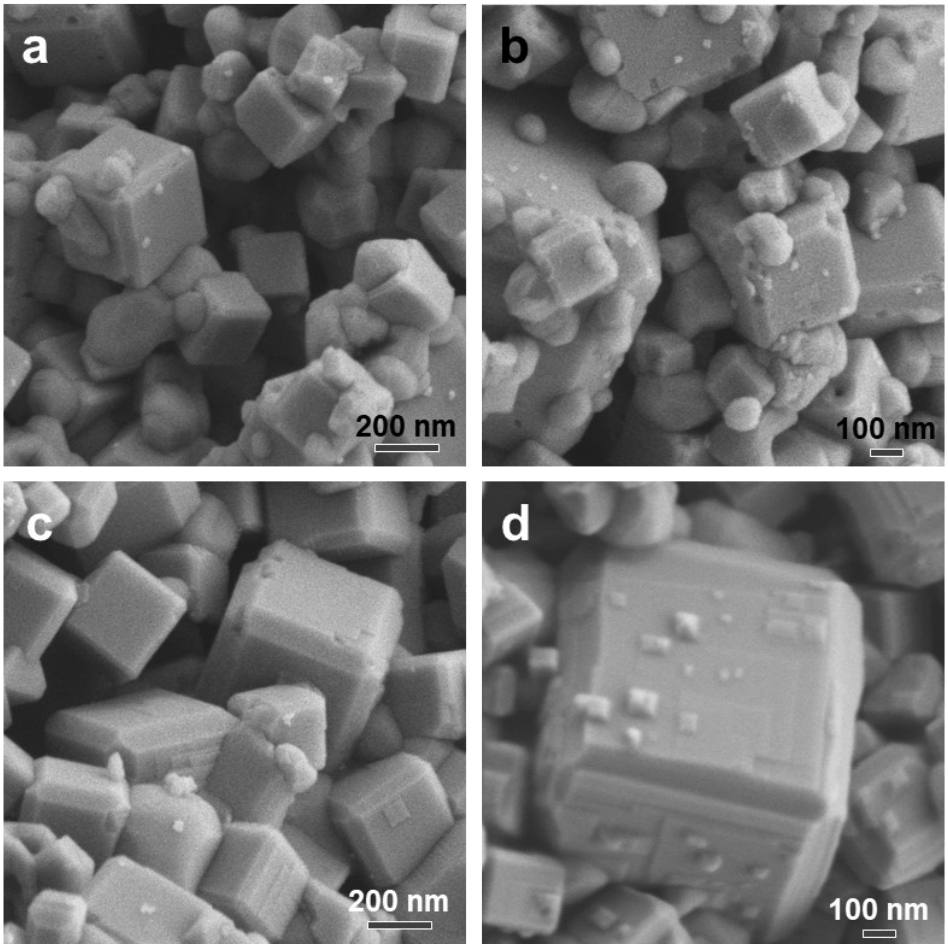

Figure S3.SEM graph of 18-STO-HM after solid-state reaction at 900 °C (a, b) and 1000 °C (c, d) for 1h.

Table S1. Surface compositions and chemical state of titanium and oxygen species over as-prepared catalysts.

Catalyst	Ti^{4+}			Ti^{3+}		O_{STO}		O_{TiO}		$O_{vacancy}$	
	BE (eV)		Cont. (%)	BE (eV)	Cont. (%)	BE (eV)	Cont. (%)	BE (eV)	Cont. (%)	BE (eV)	Cont. (%)
18-STO-HM	458.22	463.81	85.53	457.71	14.47	529.34	64.9	530.17	16.9	531.41	18.2
Step-STO-SSR	458.17	463.70	80.09	457.71	19.91	529.20	65.8	530.12	7.2	531.45	27.0

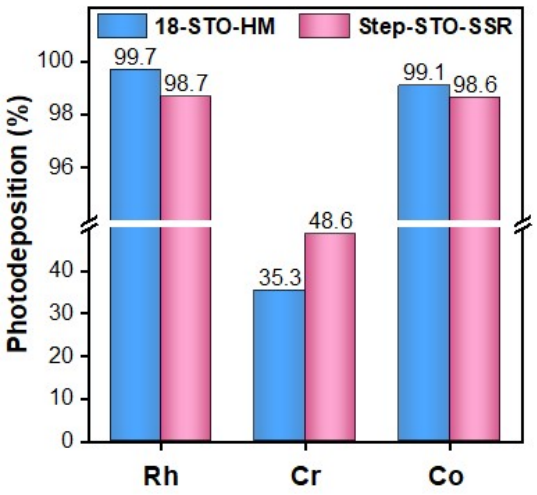

Figure S4. Photodeposition efficiency of STO loaded with 0.1 wt% Rh, 0.05 wt% Cr, and 0.05 wt% Co.

Table S2. The lifetime fitting values of time-resolved fluorescence curves.

Catalyst	$R(t) = B_1 e^{-t/\tau_1} + B_2 e^{-t/\tau_2}$			
	τ_1 (ns)	B_1 (%)	τ_2 (ns)	B_2 (%)
18-STO-HM	0.8403	74.20	4.2413	25.8
Step-STO-SSR	1.0534	68.89	9.6753	31.11

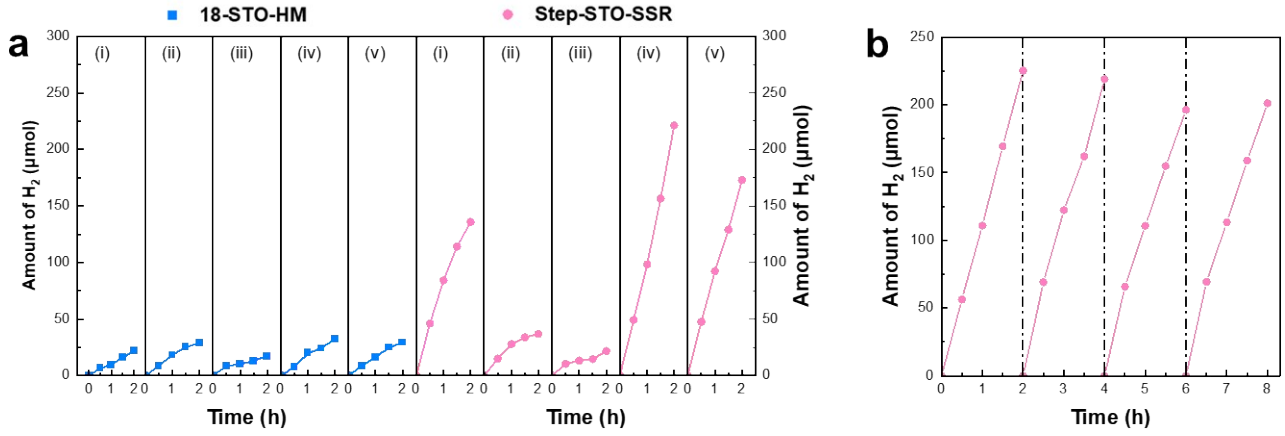

Figure S5. (a) Time course of H_2 evolution over 18-STO-HM and Step-STO-SSR loaded with Rh (0.1 wt%) (i), Cr (0.05 wt%) (ii), Co (0.05 wt%) (iii), Rh (0.1 wt%)/Cr (0.05 wt%) and, Rh (0.1 wt%)/Co (0.05 wt%) (v). (b) Stability test of Step-STO-SSR loaded with Rh (0.1 wt%)/Cr (0.05 wt%)/Co (0.05 wt%) during photocatalytic overall water splitting.