Supplementary Material

Modulating the Schottky barrier of Pt/$PbTiO_3$ for efficient piezo-photocatalytic hydrogen evolution

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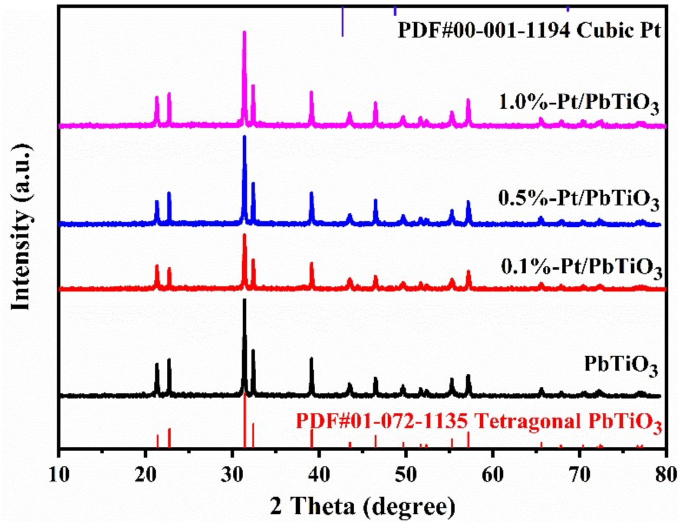

Fig. S1 Typical XRD patterns of bare $PbTiO_3$, 0.1% Pt/$PbTiO_3$, 0.5% Pt/$PbTiO_3$ and 1.0% Pt/$PbTiO_3$.

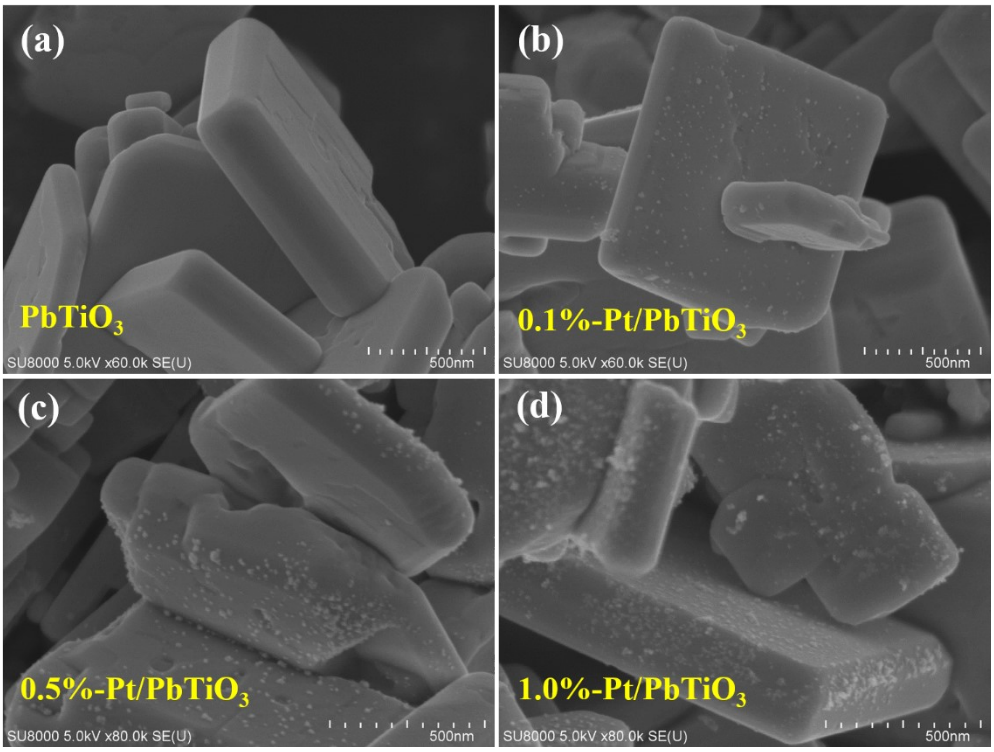

Fig. S2 SEM images of bare $PbTiO_3$, 0.1% Pt/$PbTiO_3$, 0.5% Pt/$PbTiO_3$ and 1.0% Pt/$PbTiO_3$.

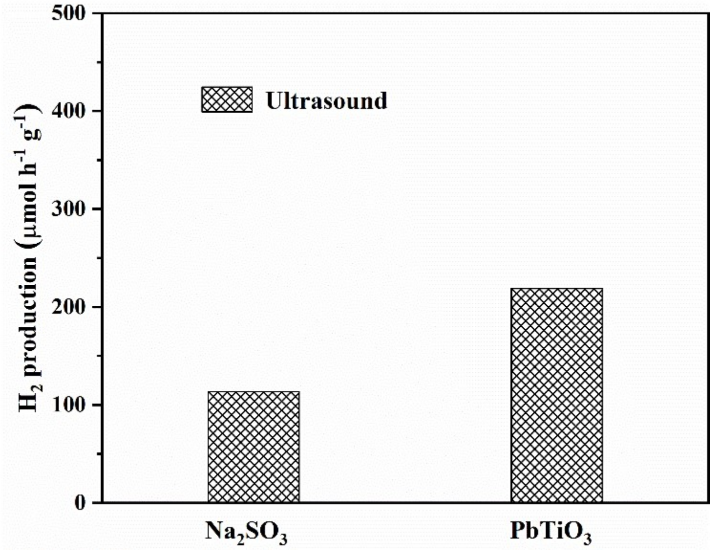

Fig. S3 Comparison diagram of piezocatalytic hydrogen evolution rates.

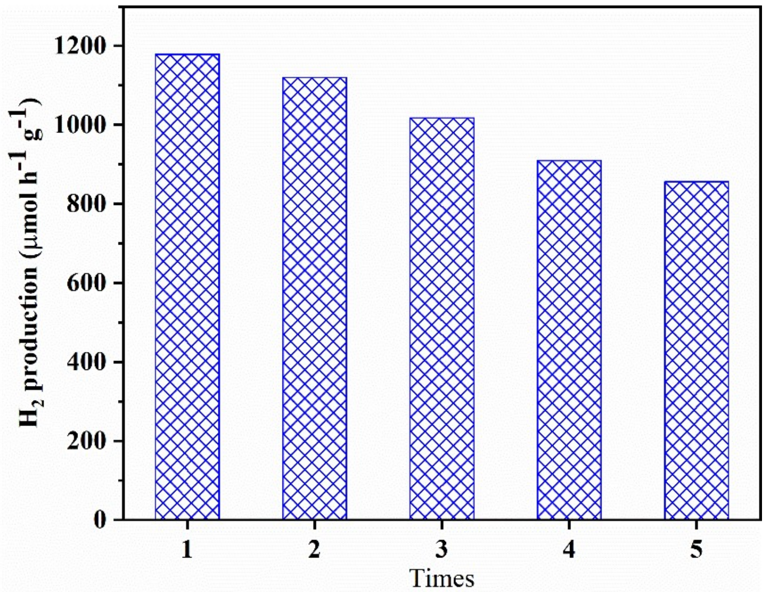

Fig. S4 Time-circle piezo-photocatalytic H_2 evolution rate on 0.5%-Pt/$PbTiO_3$.

The following formula can be used to calculate the band gap energy for one semiconductor[1].

$$\alpha h\nu = A(h\nu - E_g)^{n/2}$$

Where hν, α, A, and Eg are light energy, absorption index, constant value, and band-gap energy of semiconductor, respectively. What is more, n relies on the transition type of semiconductor. The n for direct transition is equal to 1, while n is 4 for indirect transition.

Table S1 Related parameters for the calculation of V_p of $PbTiO_3$

w_3	T_3[2]	d_{33}[3]	ε_0[4]	ε_r[5]
172 nm (according to PFM image)	1.01×10^5 kPa	70 pm/V	8.85×10^-12 F/m	550

Because of the different between the work function of Pt and the electron affinity of $PbTiO_3$, a Schottky junction forms between the $PbTiO_3$ nanoplate and Pt-coated tip. The bottom of $PbTiO_3$ nanoplate was connected to ITO conductive film. Since the piezoelectric polarization charges only existed at the top surface of nanoplate and the bottom surface of nanoplate contact with ITO and the contact between ITO and bottom nanoplate surface was rather large, the influence of the piezopotential on the bottom $PbTiO_3$-ITO contact can be neglected. Therefore, it is reasonable to assume that the Schottky barrier formed at the Pt-$PbTiO_3$ interface and dominates the IV characteristics.

Table S2 Comparison results of H_2 production rate via piezo-photocatalysis

Catalysts	Catalytic Conditions	Sacrificial Agents	Catalytic Activity	Ref.
$Bi_{0.5}Na_{0.5}TiO_3$ nanosphere	Ultrasonic (40 kHz,110 W); Xe lamp (300 W)	Triethanolamine	158 μmol h^{-1} g^{-1}	[6]
$PbTiO_3$-CdS-10%	Ultrasonic (40 kHz, 100 W); Xe lamp (300 W)(λ ≥420 nm)	0.1 M Na_2S/Na_2SO_3	849 μmol h^{-1} g^{-1}	[7]
$KNbO_3/MoS_2$ heterostructure	Ultrasonic (40 kHz,110 W); Xe lamp (300 W)	Triethanolamine	96 μmol h^{-1} g^{-1}	[8]
R3C $ZnSnO_3$ Nanowires	Ultrasonic (40 kHz,250 W); Xe lamp (150 W)	Ethyl alcohol	857 μmol h^{-1} g^{-1}	[9]
ZnO nanowires	Ultrasonic (40 kHz,50 W); Xe lamp (50 W)	Methanol	1.9 μmol h^{-1} g^{-1}	[10]
TiO_2/ZnO nanowires	Ultrasonic (40 kHz,50 W); Xe lamp (50 W)	Methanol	3.1 μmol h^{-1} g^{-1}	[10]
0.5%-Pt/$PbTiO_3$	Ultrasonic (40 kHz, 100 W); λ ≥ 400 nm, Xe lamp (300 W)	0.1 M Na_2SO_3	1181.3 μmol h^{-1} g^{-1}	This work

Reference

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