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

Supporting Information

A wide visible light driven complex perovskite $Ba(Mg_{1/3}Ta_{2/3})O_{3-x}N_y$ photocatalyst for water oxidation and reduction

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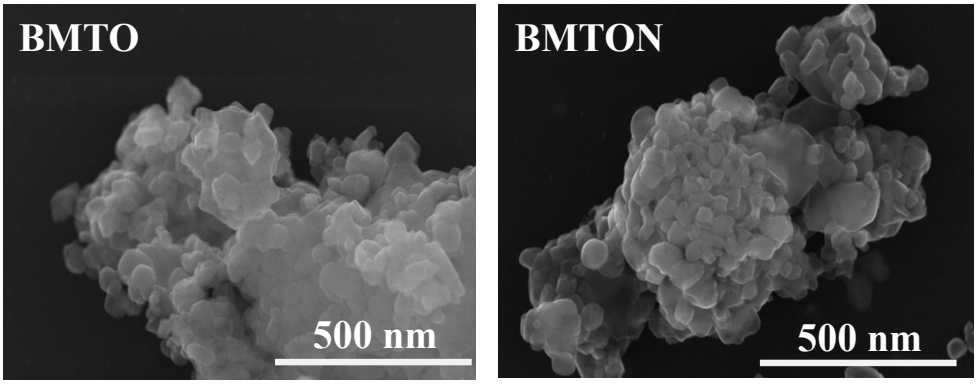

Fig S1. Representative HRSEM images of BMTO and BMTON samples.

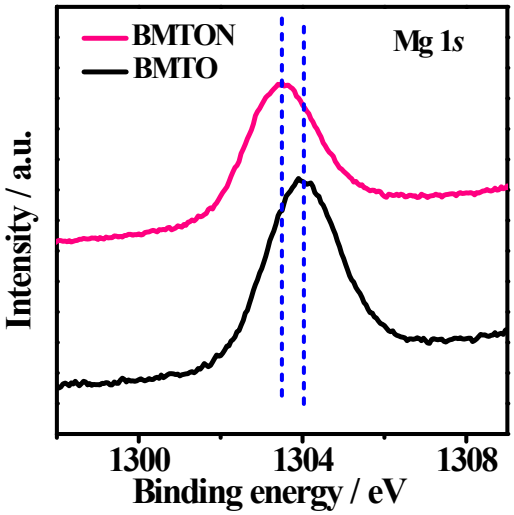

Fig S2. Mg 1*s* XPS spectra of the BMTO and BMTON samples.

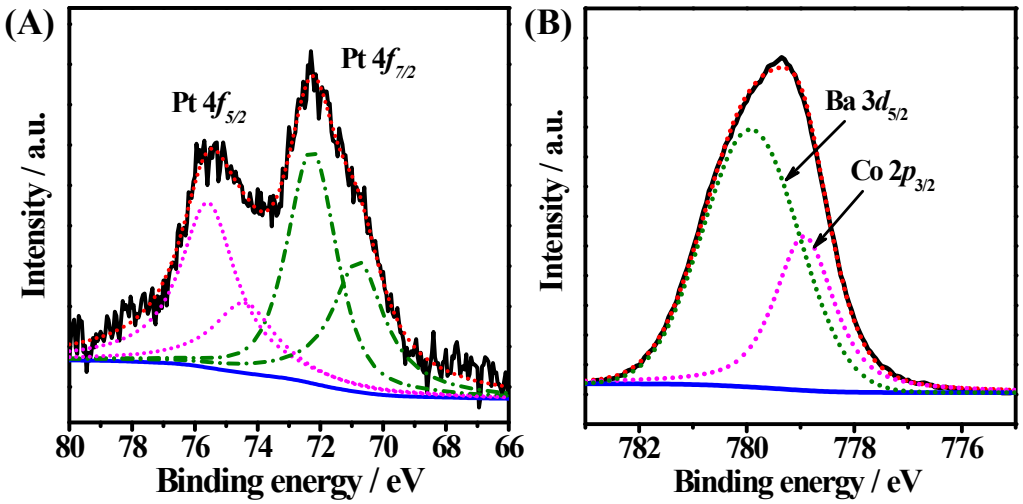

Fig S3. XPS spectra of BMTON samples: (A) Pt 4*f*; (B) Ba $3d_{5/2}$ and Co $2p_{3/2}$.

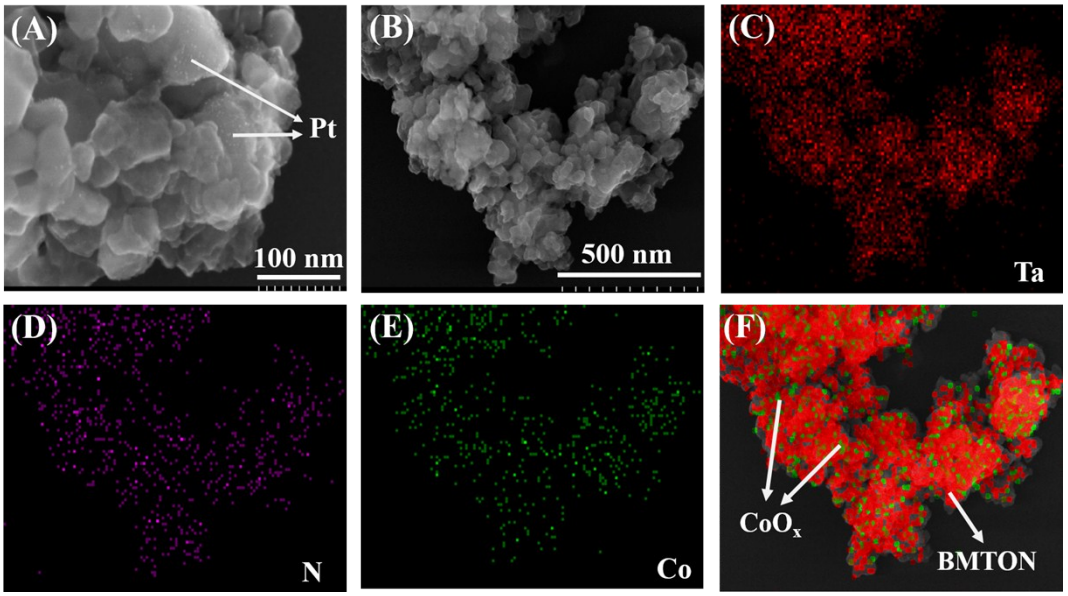

Fig S4. The HRSEM images of typical samples: (A) 0.5 *wt*% Pt/BMTON; (B) 1.0 *wt*% CoO_x/BMTON, and the elemental mappings of CoO_x/BMTON: (C) Ta element; (D) N element; (E) Co element; (F) simulated dispersion of CoO_x and BMTON.

Table S1. Photocatalytic performances of typical samples under visible light irradiation ($\lambda \geq 420$ nm).

Entry	Sample	Sacrificial reagent	The rate of gases evolution
Water reduction half reaction (**H_2**)	Pt	methanol	**0** μmol h^{-1}
	BMTON	methanol	**0** μmol h^{-1}
	Pt/BMTON	methanol	**0.9** μmol h^{-1}
Water oxidation half reaction (**O_2**)	Co_3O_4	$AgNO_3$	**0** μmol 0.5 h^{-1}
	BMTON	$AgNO_3$	**1.4** μmol 0.5 h^{-1}
	CoO_x/BMTON	$AgNO_3$	**3.5** μmol 0.5 h^{-1}

Reaction conditions: 150 mL of 20 *v*% methanol aqueous solution (for H_2 evolution half reaction) or 0.01 M $AgNO_3$ aqueous solution (for O_2 evolution half reaction) with 0.15 g of the sample; 0.15 g of La_2O_3; 300 W xenon lamp ($\lambda \geq 420$ nm).

Table S2. Photocatalytic performances of typical photocatalysts under visible light irradiation ($\lambda \geq 420$ nm).

Entry	The nitrided samples at different temperature	Cocatalyst	Sacrificial reagent	The rate of gases evolution
Water reduction half reaction (**H_2**)	923 K	Pt	methanol	**trace**
	1023 K	Pt	methanol	**0.2** μmol h^{-1}
	1123 K	Pt	methanol	**0.3** μmol h^{-1}
	1223 K	Pt	methanol	**0.9** μmol h^{-1}
Water oxidation half reaction (**O_2**)	923 K	CoO_x	$AgNO_3$	**trace**
	1023 K	CoO_x	$AgNO_3$	**1.9** μmol 0.5 h^{-1}
	1123 K	CoO_x	$AgNO_3$	**2.2** μmol 0.5 h^{-1}
	1223 K	CoO_x	$AgNO_3$	**3.5** μmol 0.5 h^{-1}

Reaction conditions: 150 mL of 20 *v*% methanol aqueous solution (for H_2 evolution half reaction) or 0.01 M $AgNO_3$ aqueous solution (for O_2 evolution half reaction) with 0.15 g of the photocatalyst; 0.15 g of La_2O_3; 300 W xenon lamp ($\lambda \geq 420$ nm).

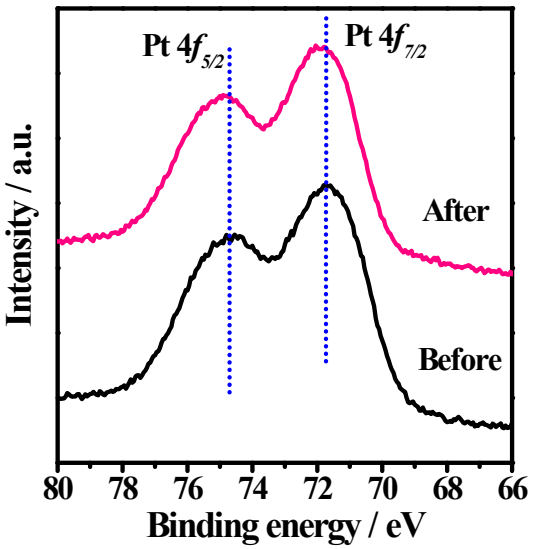

Fig S5. Pt 4*f* XPS spectra of 0.5 *wt*% Pt/BMTON samples before and after photocatalytic hydrogen evolution half reaction.

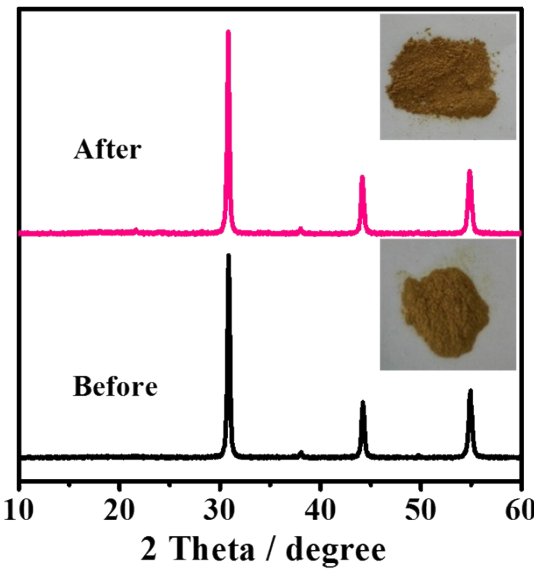

Fig S6. XRD patterns of BMTON samples before and after photocatalytic hydrogen evolution reaction.