Supporting Information:

$BiVO_4$-Ru/$SrTiO_3$:Rh Composite of Z-Scheme Photocatalyst for Solar Water Splitting

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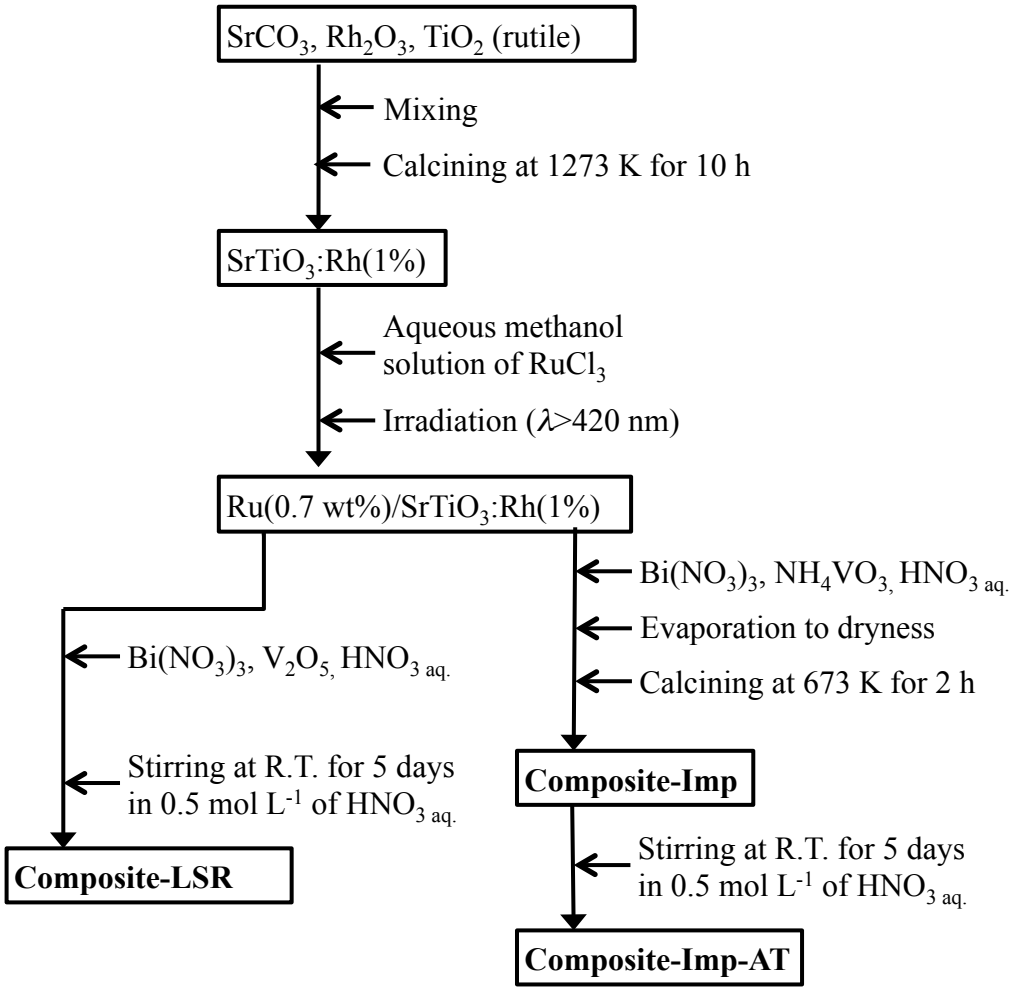

Fig. S1 Schematic flow chart of the synthetic procedures for the $BiVO_4$-Ru/$SrTiO_3$:Rh composite.

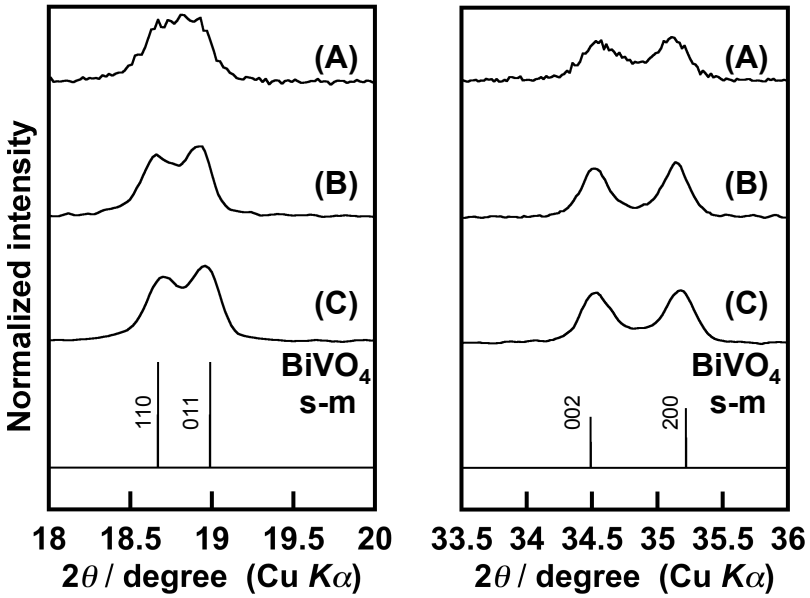

Fig. S2 X-ray diffraction patterns of $BiVO_4$(250 wt%)-Ru(0.7 wt%)/$SrTiO_3$:Rh(1%) composite of Z-scheme photocatalyst.
Methods for preparation of composites: (A) impregnation (Composite-Imp), (B) nitric acid treatment at room temperature for 5 days after impregnation (Composite-Imp-AT), and (C) a liquid-solid state reaction (Composite-LSR).
$SrTiO_3$:Rh was prepared by a solid state reaction at 1273 K for 10 h. Ru cocatalyst was loaded by photodeposition.

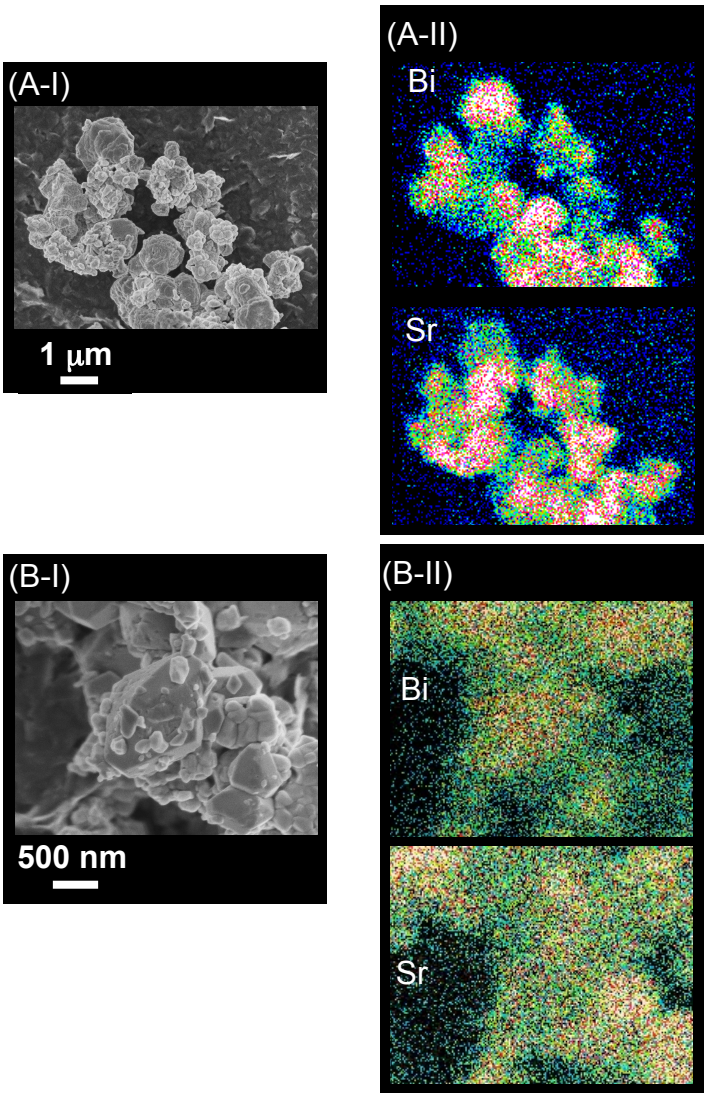

Fig. S3 (A-I), (B-I) Scannig electron microscope images and (A-II), (B-II) EDS mapping images of $BiVO_4$(250 wt%)-Ru(0.7 wt%)/$SrTiO_3$:Rh(1%) composites.
Methods for preparation of composites: (A) impregnation (Composite-Imp), (B) a liquid-solid state reaction(Composite-LSR).

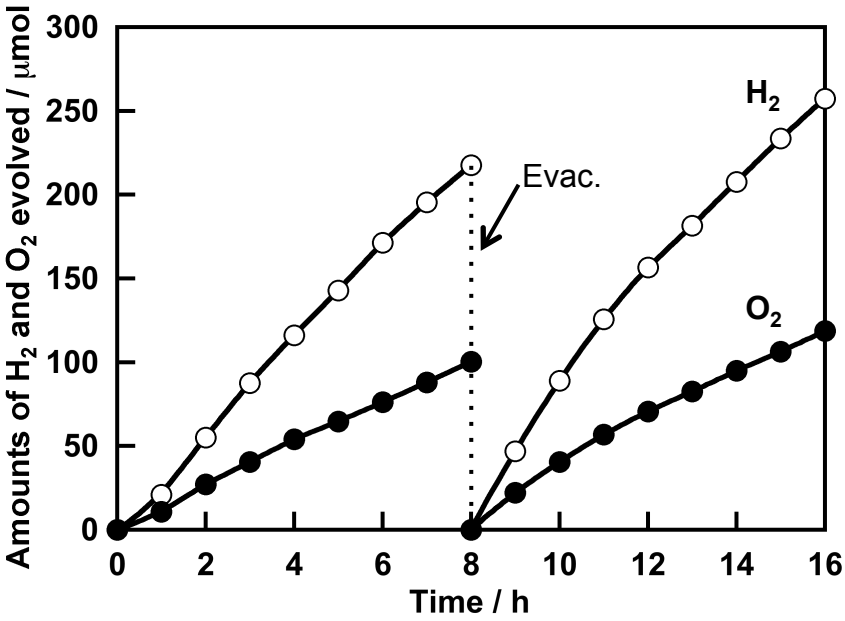

Fig. S4 Water splitting over $BiVO_4$(250 wt%)-Ru(0.7 wt%)/ $SrTiO_3$:Rh(1%) composite (Composite-LSR) of Z-scheme photocatalyst under visible light irradiation without adjustment of pH. Catalyst: 0.3 g; light source: 300 W Xe-lamp with a cold mirror and a cutoff filter (420 nm < λ < 800 nm); reactor: top irradiation cell with Pyrex window.

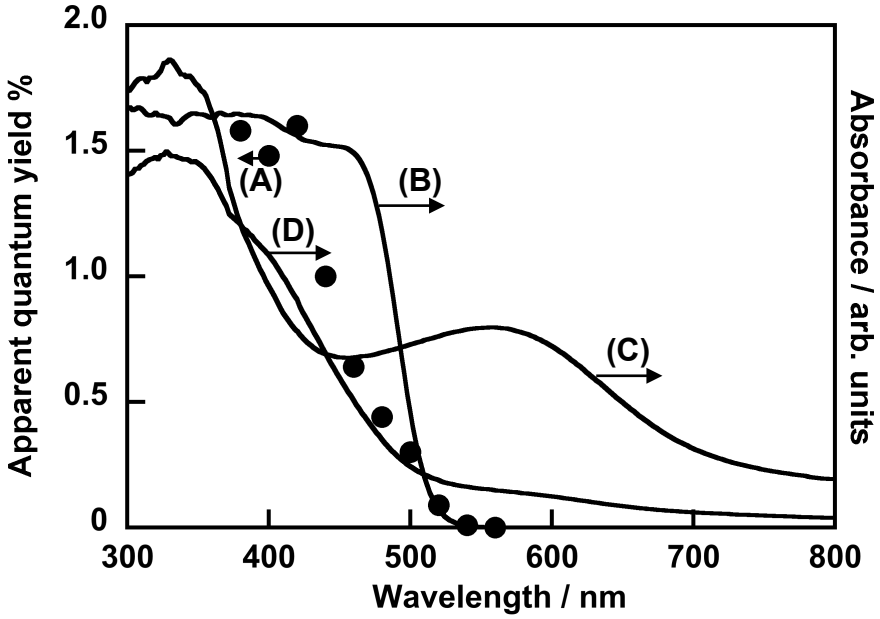

Fig. S5 Photoresponse of the composite Z-scheme photocatalysis system. (A) Action spectrum of overall water splitting over $BiVO_4$(250 wt%)-Ru(0.7 wt%)/ $SrTiO_3$:Rh(1%) composite of Z-scheme photocatalyst system, (B) diffuse reflection spectra of $BiVO_4$, (C) $SrTiO_3$:Rh(1%), and (D) $SrTiO_3$:Rh(1%) reduced with H_2 at 673 K.

Table S1 Effect of pH on photocatalytic activities for H_2 evolution over $Ru/SrTiO_3$:Rh photocatalyst and O_2 evolution over $BiVO_4$ photocatalyst.

Entry	Photocatalyst	pH	Reaction condition	Rate of H_2 evolution /μmol h^{-1}	Rate of O_2 evolution /μmol h^{-1}
1	$Ru(0.7\ wt\%)/SrTiO_3$:Rh(1%)	8.7	10 vol % of CH_3OH aq.	43	-
2	$Ru(0.7\ wt\%)/SrTiO_3$:Rh(1%)	3.5[a]	10 vol % of CH_3OH aq.	30	-
3	$BiVO_4$	5.4	20 mmol L^{-1} of $AgNO_3$ aq.	-	130
4	$BiVO_4$	3.4[b]	20 mmol L^{-1} of $AgNO_3$ aq.	-	140

Catalyst: 0.2 g; water: 150 mL (pH was adjusted by [a]$H_2SO_{4\ aq.}$ or [b]$HNO_{3\ aq.}$); light source: 300 W Xe-arc lamp with a cold mirror and a cut-off filter (420 nm ≤ λ ≤ 800 nm); reactor: top irradiation cell with a Pyrex window.