Electronic Supplementary Material (ESI) for Chemical Science.

Supporting Information

Solar water splitting over $Rh_{0.5}Cr_{1.5}O_3$-loaded $AgTaO_3$ of a valence-band-controlled metal oxide photocatalyst

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Table S1 Photocatalytic water splitting over $Rh_{0.5}Cr_{1.5}O_3$(0.3 wt%)/$AgTaO_3$ synthesized by a solid state reaction with various excess amount of Ag under various calcination conditions under UV irradiation.

Calcination condition		Excess Ag / mol%	Activity / μmol h^{-1}	
Temperature / K	Time / h		H_2	O_2
1173	10	0	130	166
1273	5	0	156	80
1273	10	0	171	87
1273	15	0	181	95
1273	15	3	149	78
1273	15	5	180	95
1273	15	7	151	76
1273	20	0	163	83
1373	10	0	120	60

Photocatalyst: 0.3 g, reactant solution: distilled water (120 mL), cell: top-irradiation cell with a Pyrex window, light source: 300 W Xe-arc lamp (λ > 300 nm).

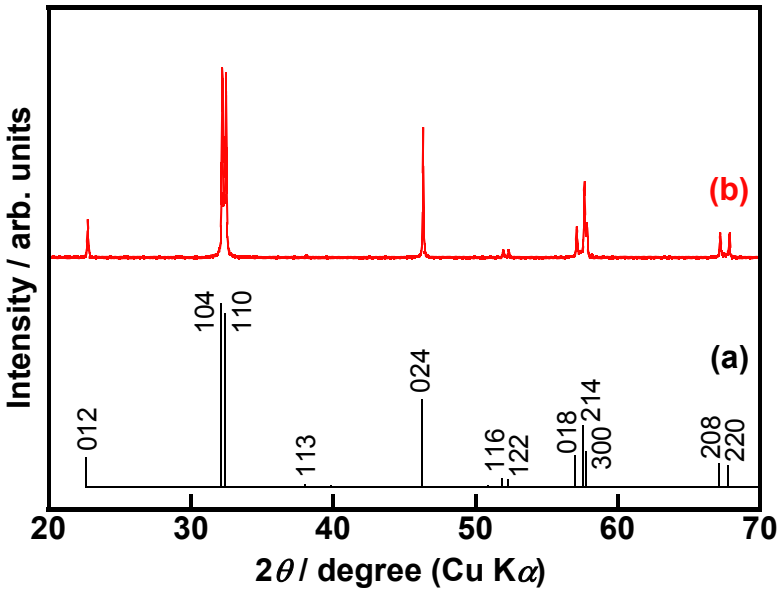

Fig. S1 (a) PDF of trigonal $AgTaO_3$ (1-72-1383). (b) XRD pattern of $AgTaO_3$ prepared by a solid state reaction at 1273 K for 15 h without excess Ag. Peaks due to $K\alpha_2$ were removed.

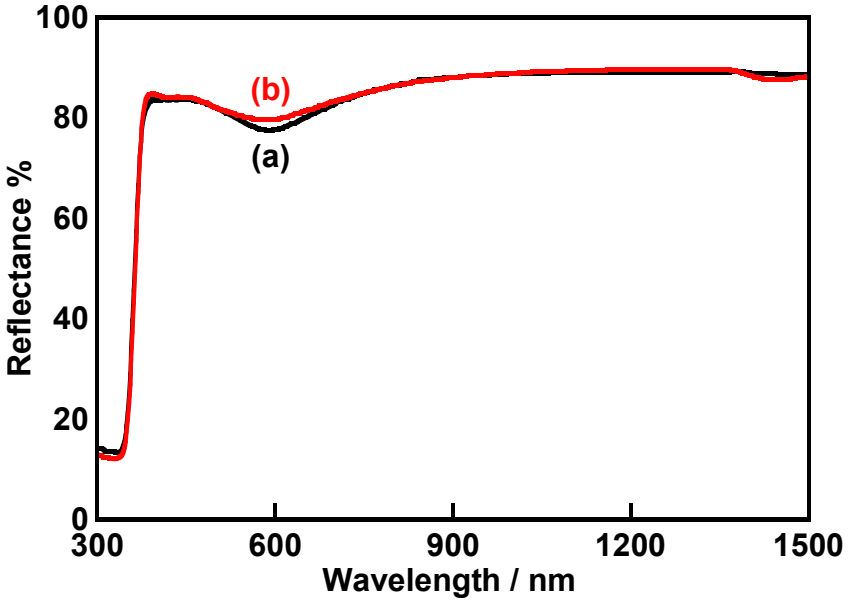

Fig. S2 A diffuse reflectance spectrum of $AgTaO_3$ (a) before and (b) after washing with an aqueous HNO_3 solution. $AgTaO_3$ was prepared by a solid state reaction at 1273 K for 15 h without excess Ag.

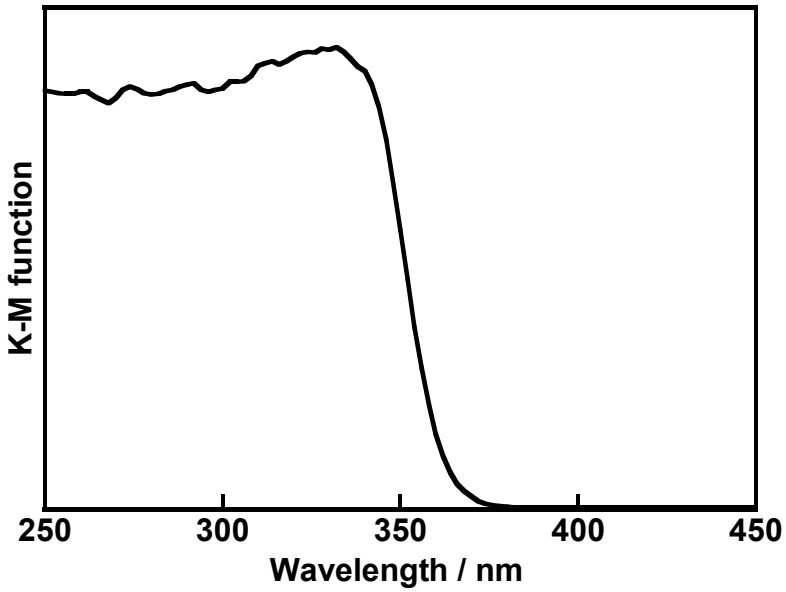

Fig. S3 A diffuse reflectance spectrum of $AgTaO_3$ prepared by a solid state reaction at 1273 K for 15 h without excess Ag.

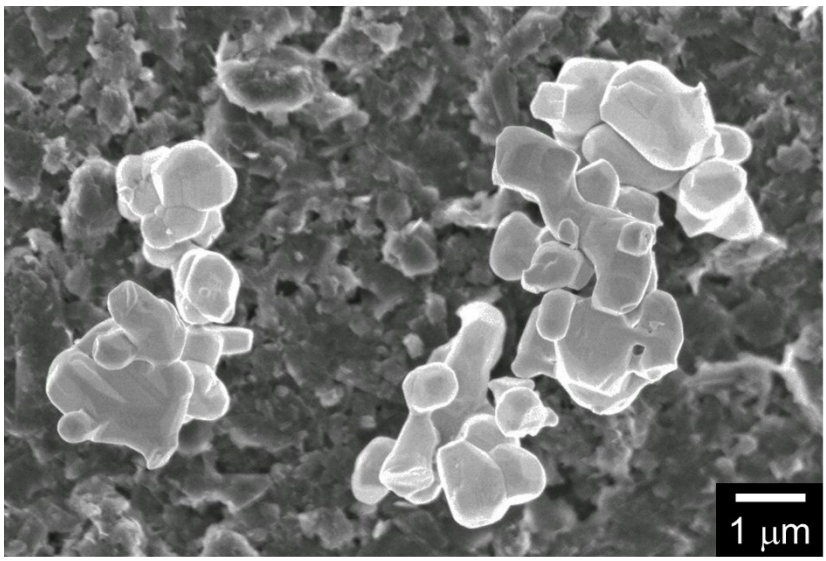

Fig. S4 Scanning electron microscopy image of $AgTaO_3$ prepared by a solid state reaction at 1273 K for 15 h without excess Ag.

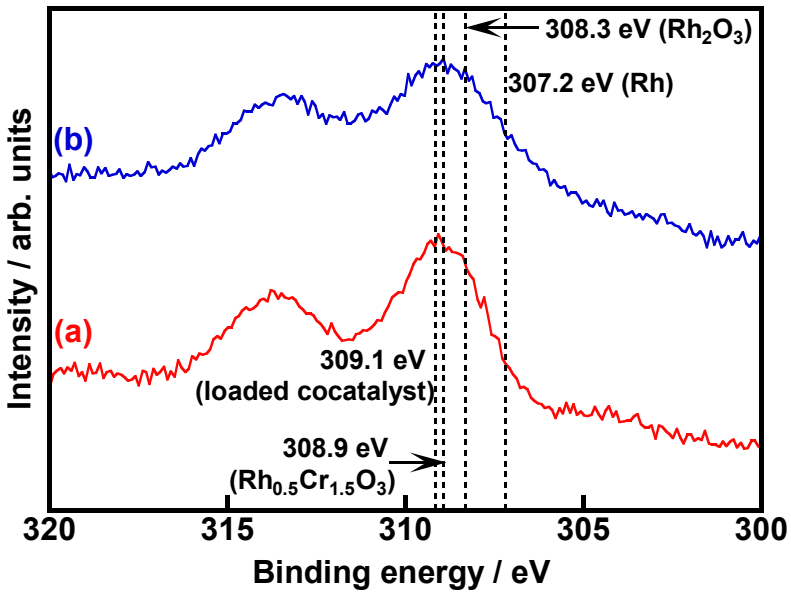

Fig. S5 X-ray photoelectron spectra of Rh 3d for $Rh_{0.5}Cr_{1.5}O_3$(0.2 wt%)/$AgTaO_3$ (a) before and (b) after photocatalytic water splitting under UV irradiation using a 300 W Xe-arc lamp. $AgTaO_3$ was synthesized by a solid state reaction at 1273 K for 15 h without excess Ag. $Rh_{0.5}Cr_{1.5}O_3$ was loaded by an impregnation method at 623 K for 1 h. Binding energies of all peaks were calibrated with C 1s (284.2 eV). All assigned binding energies for Rh, Rh_2O_3, $Rh_{0.5}Cr_{1.5}O_3$ and loaded cocatalyst were referred to a previous report.[1,2)]

References

1) C. D. Wagner, W. M. Riggs, L. E. Davis, J. F. Moulder and G. E. Muilenberg, *Perkin-Elmer Corporation, Physical Electronics Division, Eden Prairie, Minn.*, 1979.

2) K. Maeda, K. Teramura, D. Lu, T. Takata, N. Saito, Y. Inoue and K. Domen, *J. Phys. Chem. B,* 2006, **110***,* 13753–13758.