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

Supplementary Information

Development of visible-light-responsive Ru-doped $KTaO_3$ photocatalyst for overall water splitting with one-step photoexcitation and the effects of codoping with La

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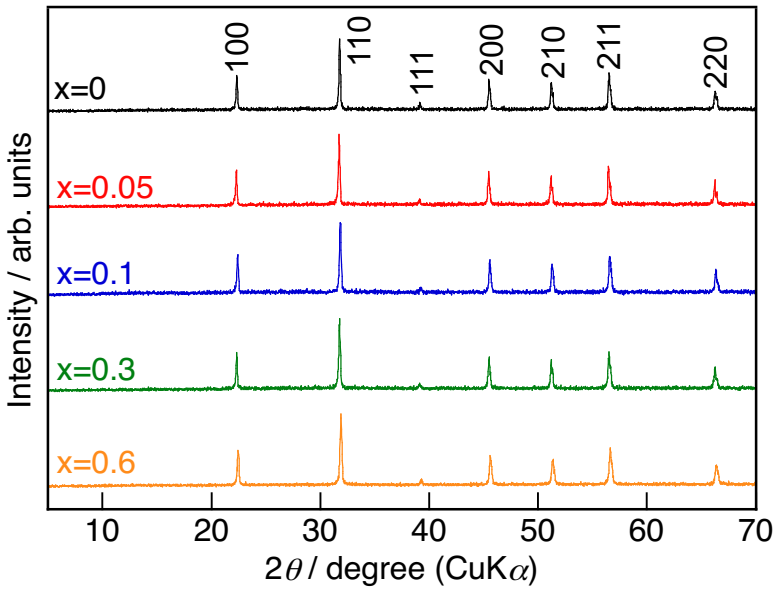

Figure S1. XRD patterns of $KTaO_3$:Ru(0.3%),La(x%).

Table S1 Crystallite size of $KTaO_3$:Ru(0.3%),La(x%) estimated by Rietveld refinement

Photocatalyst	Crystallite size / nm
$KTaO_3$:Ru(0.3%)	44.2
$KTaO_3$:Ru(0.3%),La(0.05%)	44.4
$KTaO_3$:Ru(0.3%),La(0.1%)	42.0
$KTaO_3$:Ru(0.3%),La(0.3%)	41.6
$KTaO_3$:Ru(0.3%),La(0.6%)	42.0

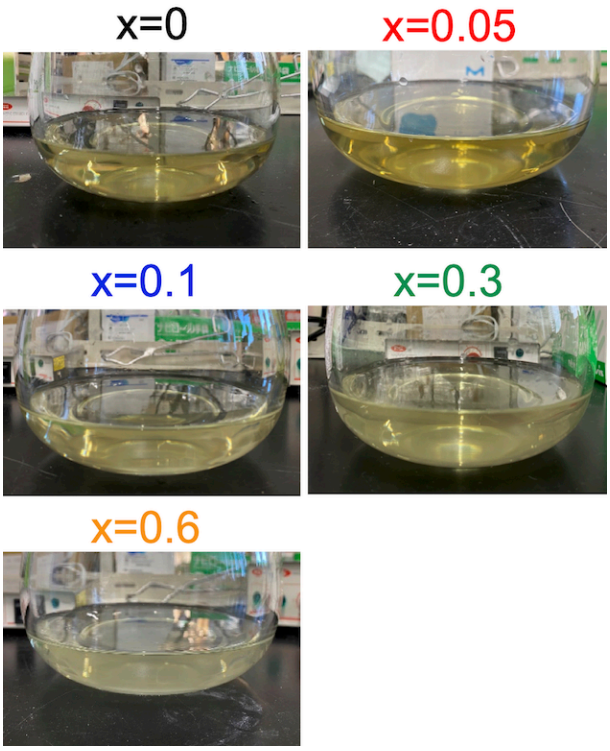

Fig. S2 Filtrates of $KTaO_3$:Ru(0.3%),La(x%) after preparation by a solid-state reaction.

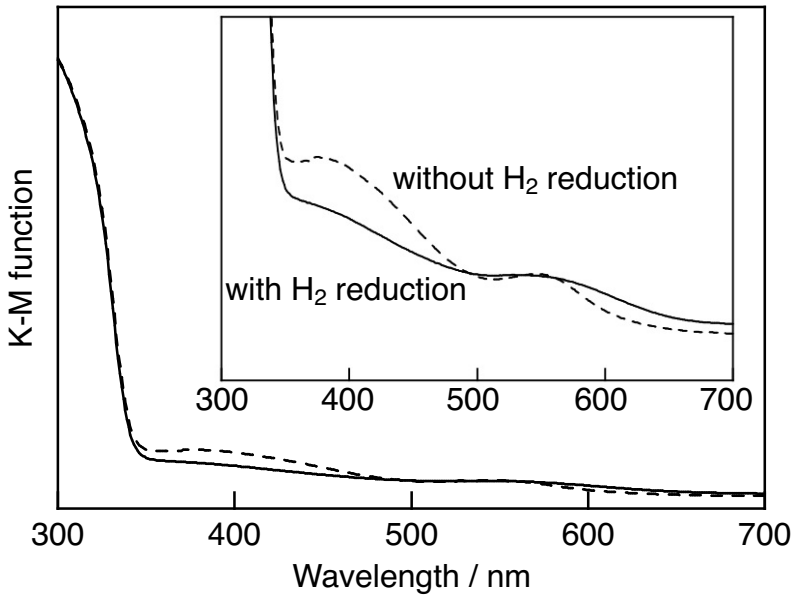

Fig. S3 Diffuse reflectance spectra of $KTaO_3$:Ru(0.3%),La(0.6%) with and without H_2-reduction at 573K.

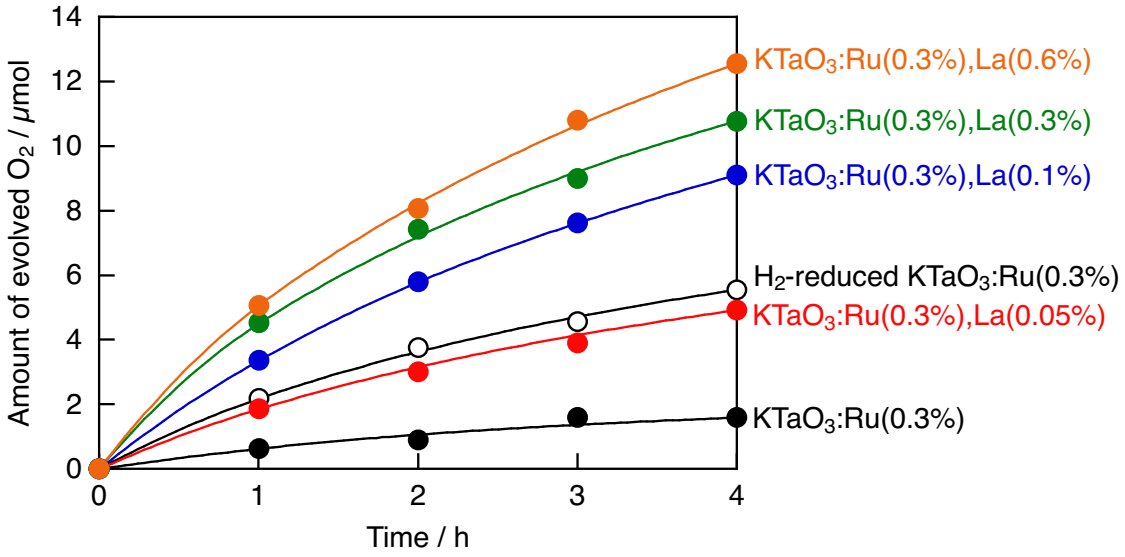

Fig. S4 Sacrificial O_2 evolution over $KTaO_3$:Ru(0.3%),La(x%) and H_2-reduced $KTaO_3$:Ru(0.3%) under visible light irradiation.

Photocatalyst: 0.3 g, reactant solution: 20 mmol L^{-1} $AgNO_{3\ aq.}$ 120 mL, light source: 300 W Xe lamp with a long-pass filter (HOYA L42, $\lambda \geq 420$ nm), cell: top-irradiation cell with a Pyrex window.

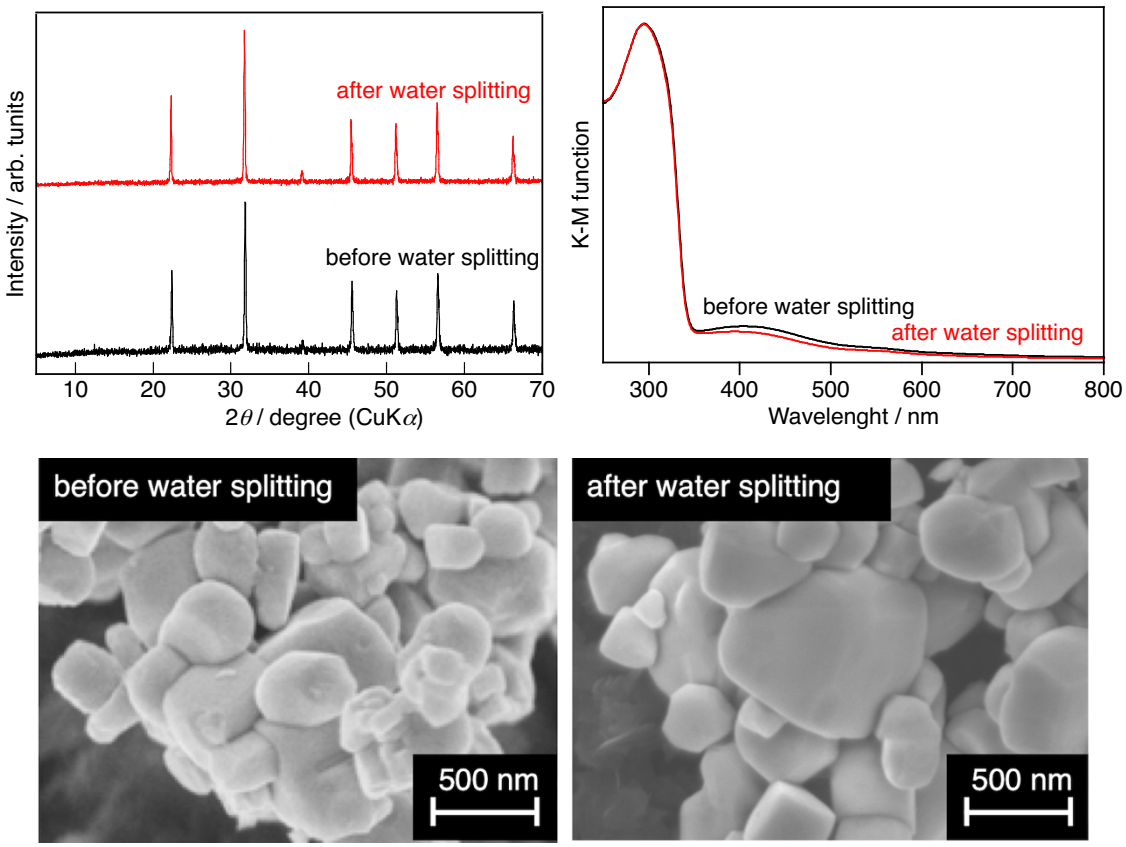

Fig. S5 XRD patterns, diffuse reflectance spectra, and SEM images of $KTaO_3$:Ru(0.3%),La(0.1%) before and after overall water splitting under visible light irradiation.

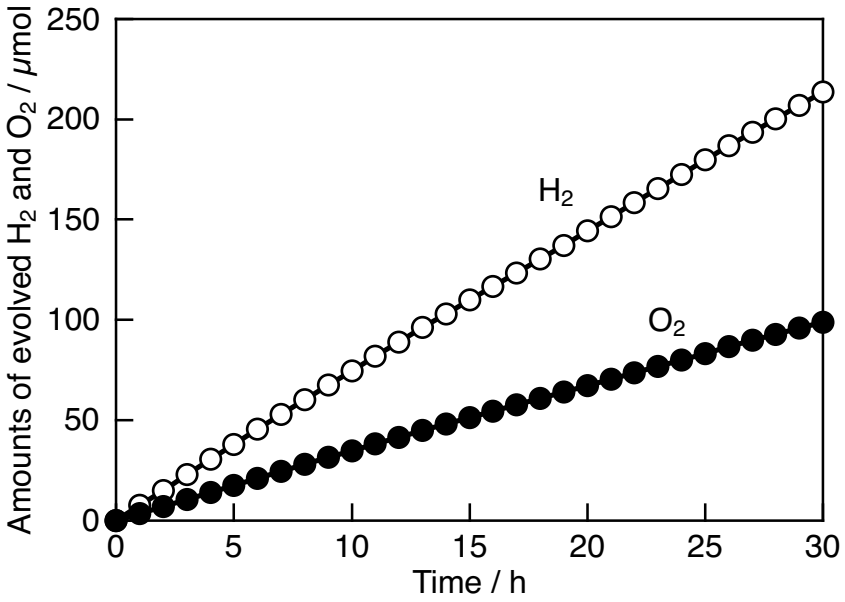

Fig. S6 Overall water splitting over Rh(0.05 wt%)/Cr_2O_3(0.038 wt%)-loaded $KTaO_3$:Ru(0.3%),La(0.1%) under UV and visible light irradiation. Photocatalyst: 0.3 g, reactant solution: water 120 mL, light source: 300 W Xe lamp, cell: top-irradiation cell with a Pyrex window.