

Supporting Information

Tungstic acids H_2WO_4 and H_4WO_5 as stable photocatalysts for water oxidation under visible light

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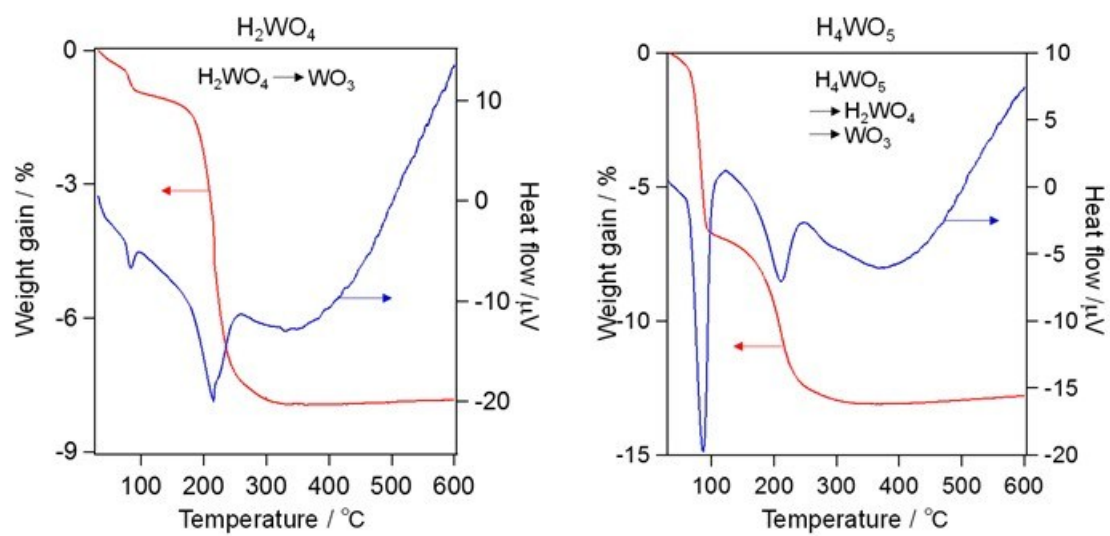


Fig. S1. TG-DTA profiles of H_2WO_4 -W and H_4WO_5 .

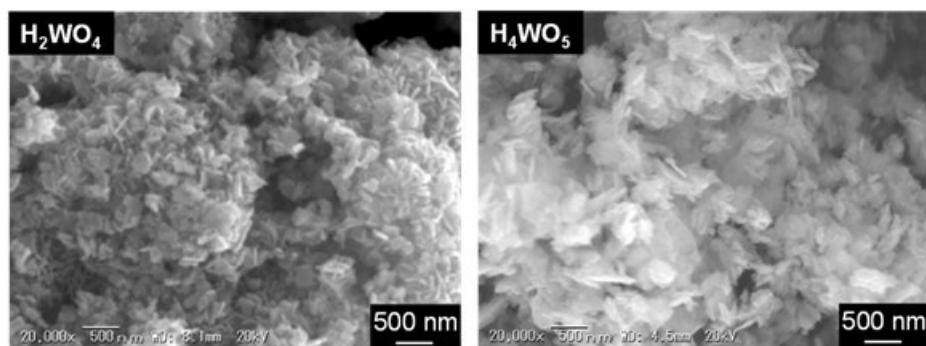


Fig. S2. SEM images of H_2WO_4 -W and H_4WO_5 .

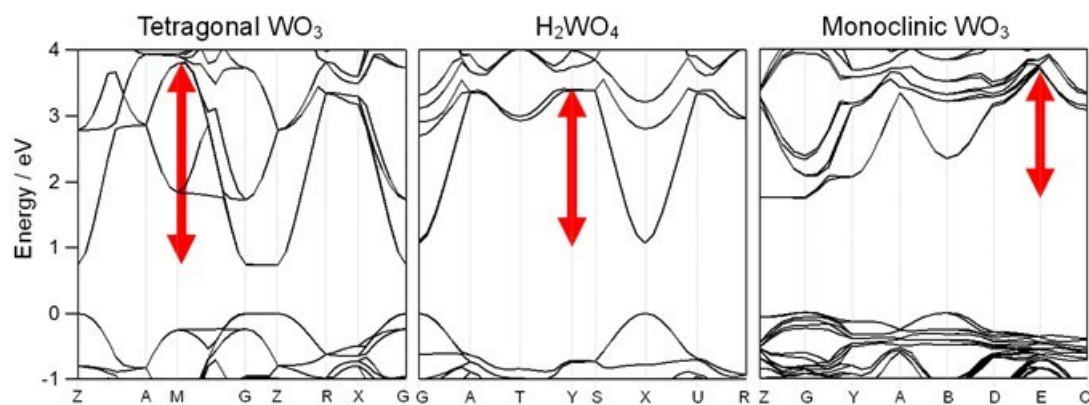


Fig. S3 Band structures of H_2WO_4 , $t\text{-WO}_3$, and $m\text{-WO}_3$. The energy was calculated using the generalized gradient approximation (GGA) of DFT proposed by Perdew, Burke, and Ernzerhof (PBE). The electronic states were expanded using a plane wave basis set with a cutoff of 340 eV. Geometry optimization calculation was performed before electronic structure calculation using the Broyden–Fletcher–Goldfarb–Shanno (BFGS) algorithm.

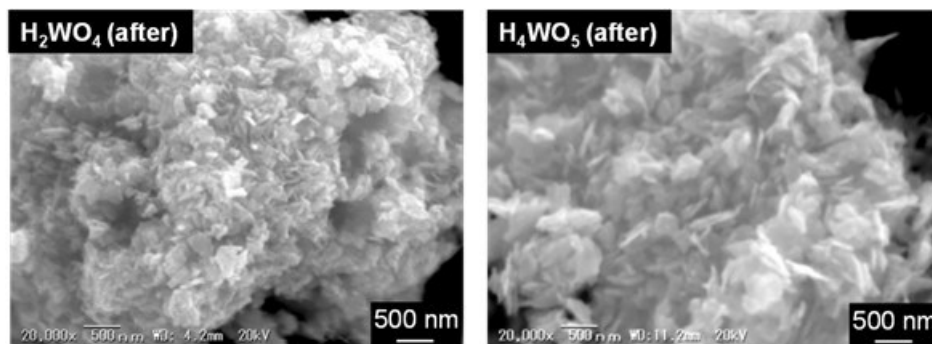


Fig. S4. SEM images of $\text{H}_2\text{WO}_4\text{-W}$ and H_4WO_5 after O_2 evolution from aqueous $\text{Fe}(\text{ClO}_4)_3$ solution under visible light ($\lambda > 400 \text{ nm}$).

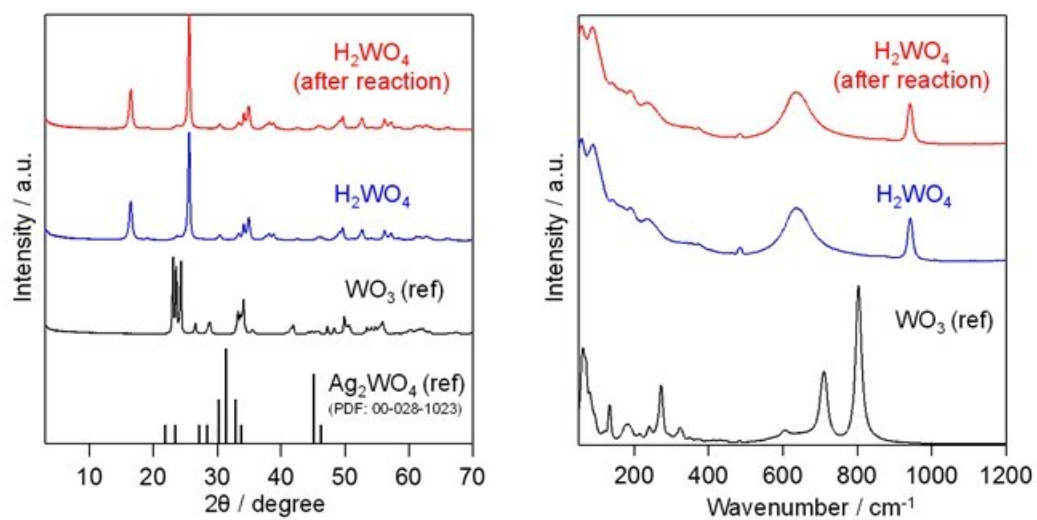


Fig. S5. XRD patterns and Raman spectra of H₂WO₄-W before and after visible light irradiation ($\lambda > 400$ nm) in AgNO₃ aqueous solution.

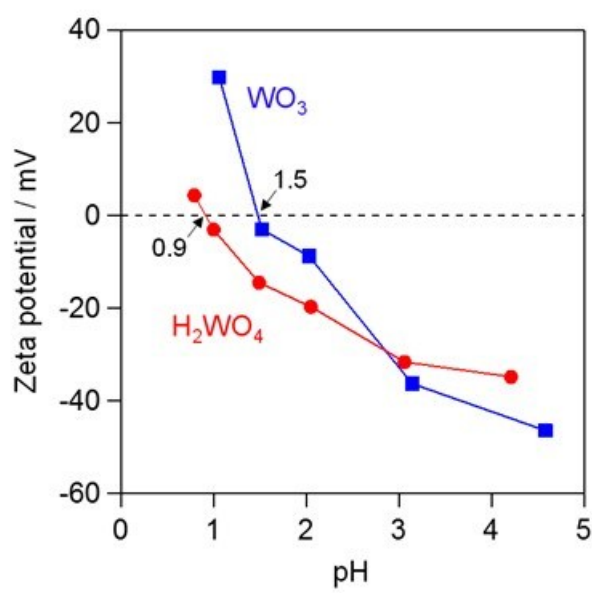


Fig. S6. Zeta potentials of H₂WO₄-W and *m*-WO₃. (pH was adjusted by HCl(aq.))

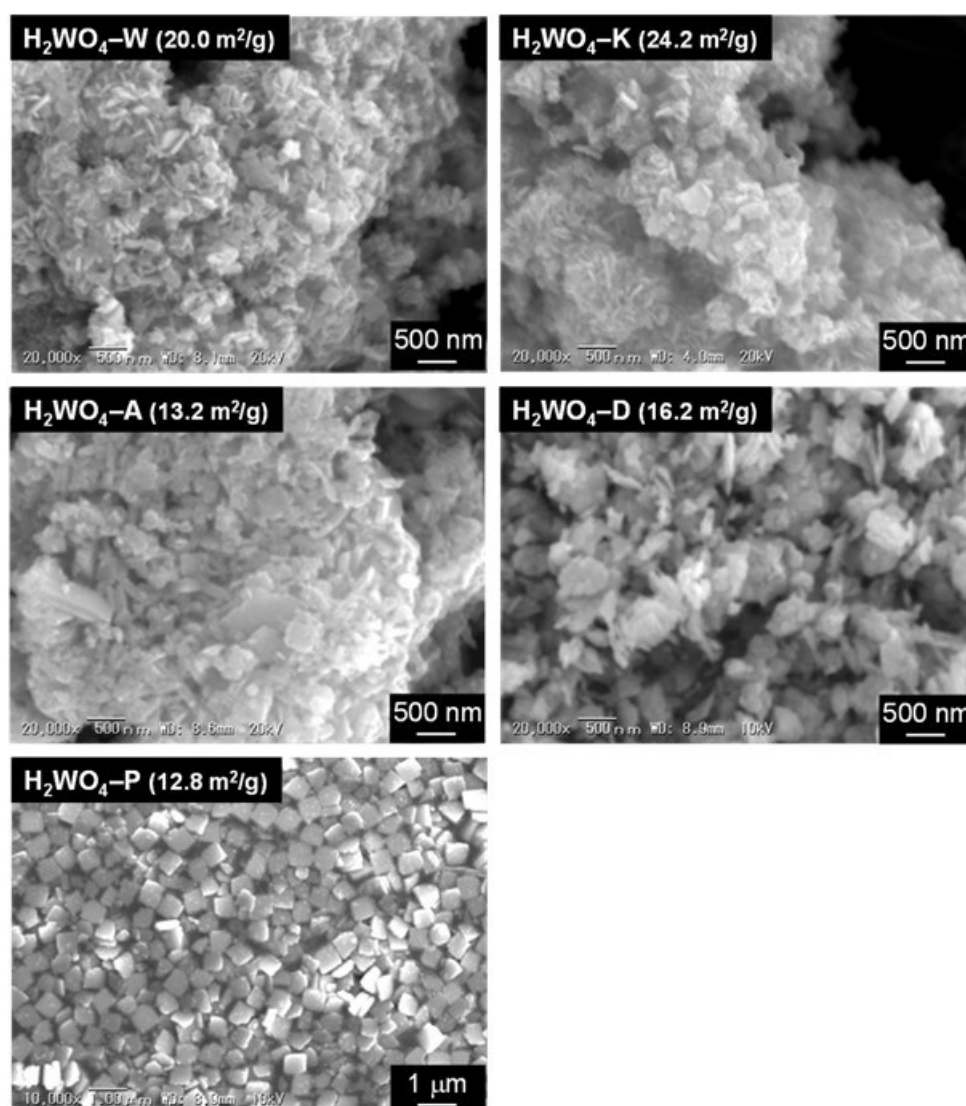


Fig. S7. SEM images of various H_2WO_4 samples.

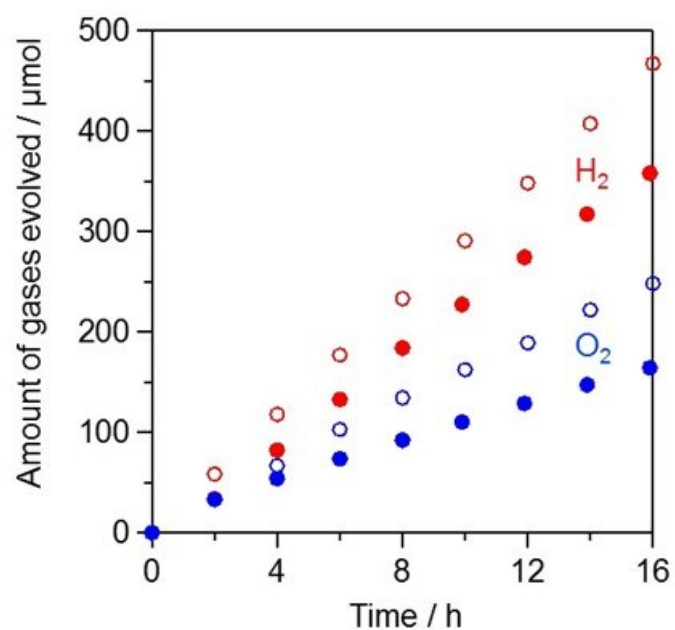


Fig. S8. Time courses of H₂ and O₂ evolution using a mixture of Ru/SrTiO₃:Rh and H₂WO₄ (closed circles) and a mixture of Ru/SrTiO₃:Rh and WO₃ (open circles) in Fe(ClO₄)₃ aqueous solution (5 mM, pH 2.3) under visible light irradiation ($\lambda > 400$ nm, Xe lamp).