

Supporting Information

Visible-Light-Active Photoelectrochemical Z-Scheme System Based on Top 5 Clarke-Number Elements

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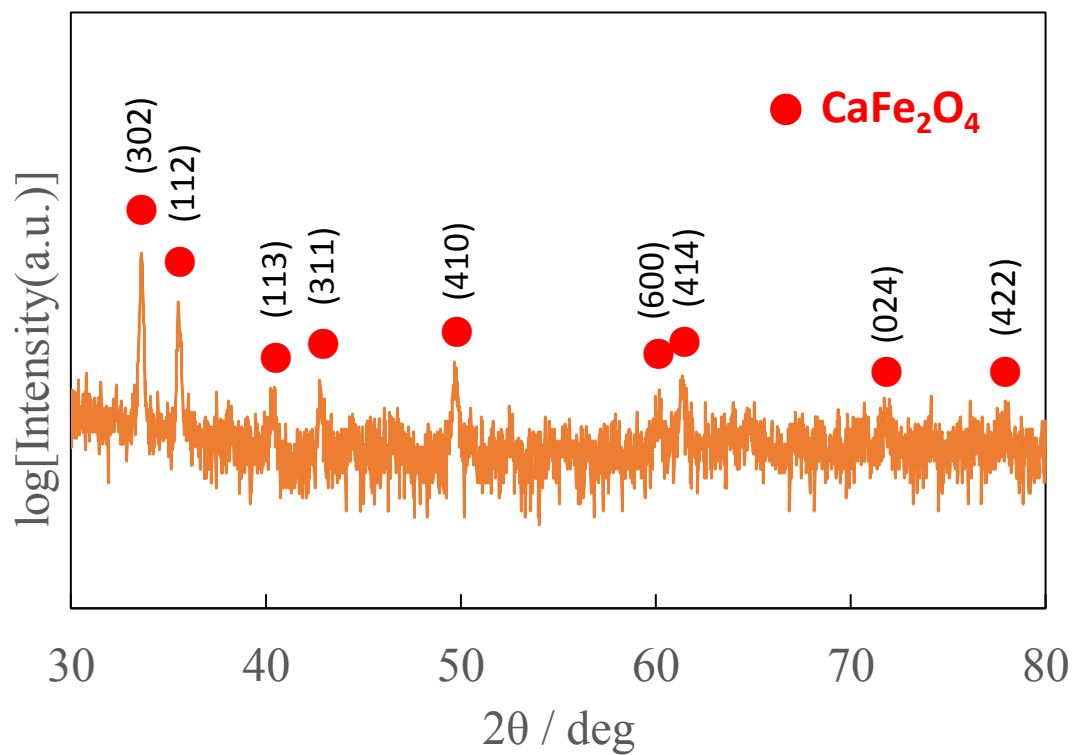


Figure S1. XRD pattern for the 800 nm-thick CaFe_2O_4 film.

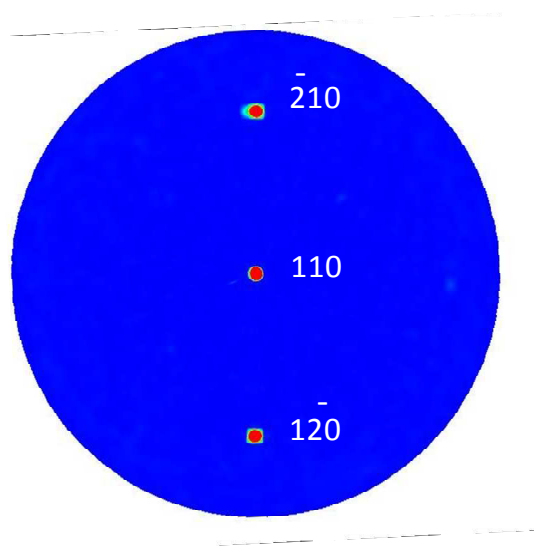


Figure S2. Pole figure of (11-20) $\alpha\text{-Fe}_2\text{O}_3$ thin film grown on (101) Ta:SnO₂ film. The 2θ angle was fixed at 35.7 degree.

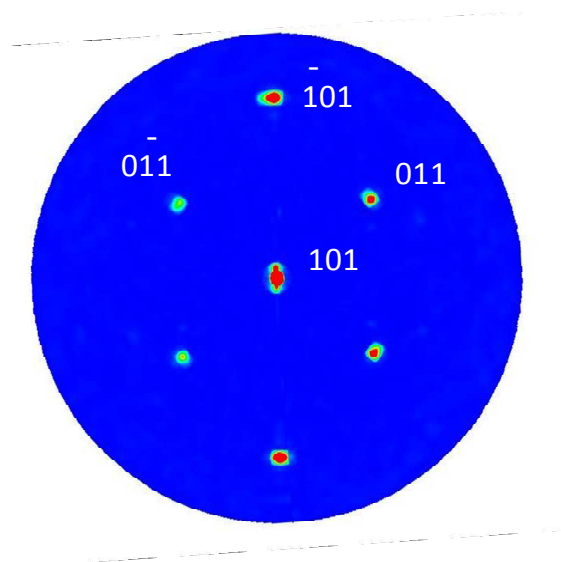


Figure S3. Pole figure of (101) Ta:SnO₂ thin film on the a-plane sapphire ((110) α -Al₂O₃) substrate. The 2θ angle was fixed at 33.8 degree.

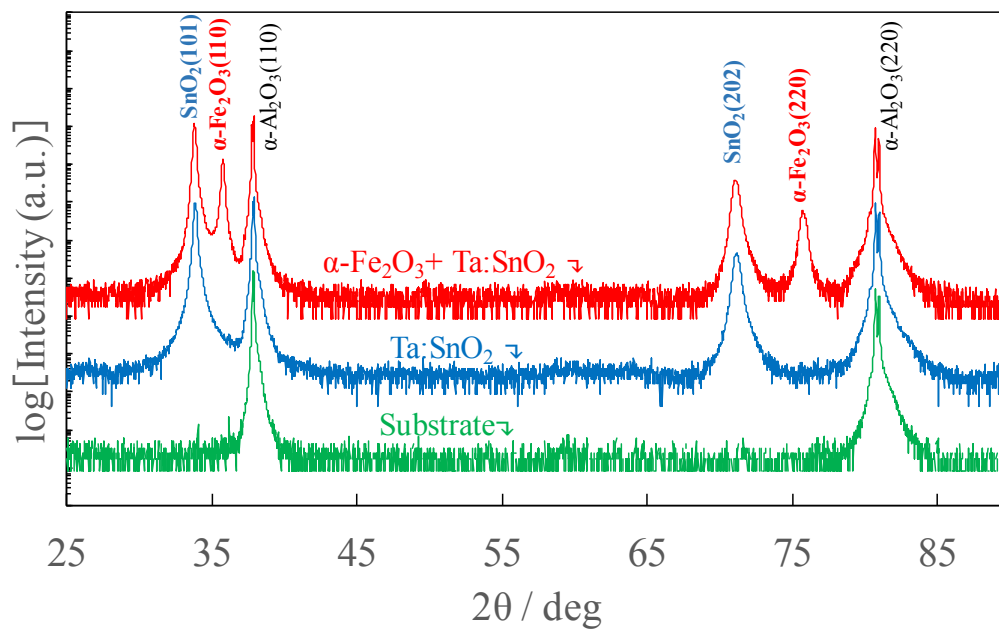


Figure S4. XRD patterns of sapphire substrate ((110) α -Al₂O₃), Ta:SnO₂ thin film, and α -Fe₂O₃/Ta:SnO₂ thin film, respectively.

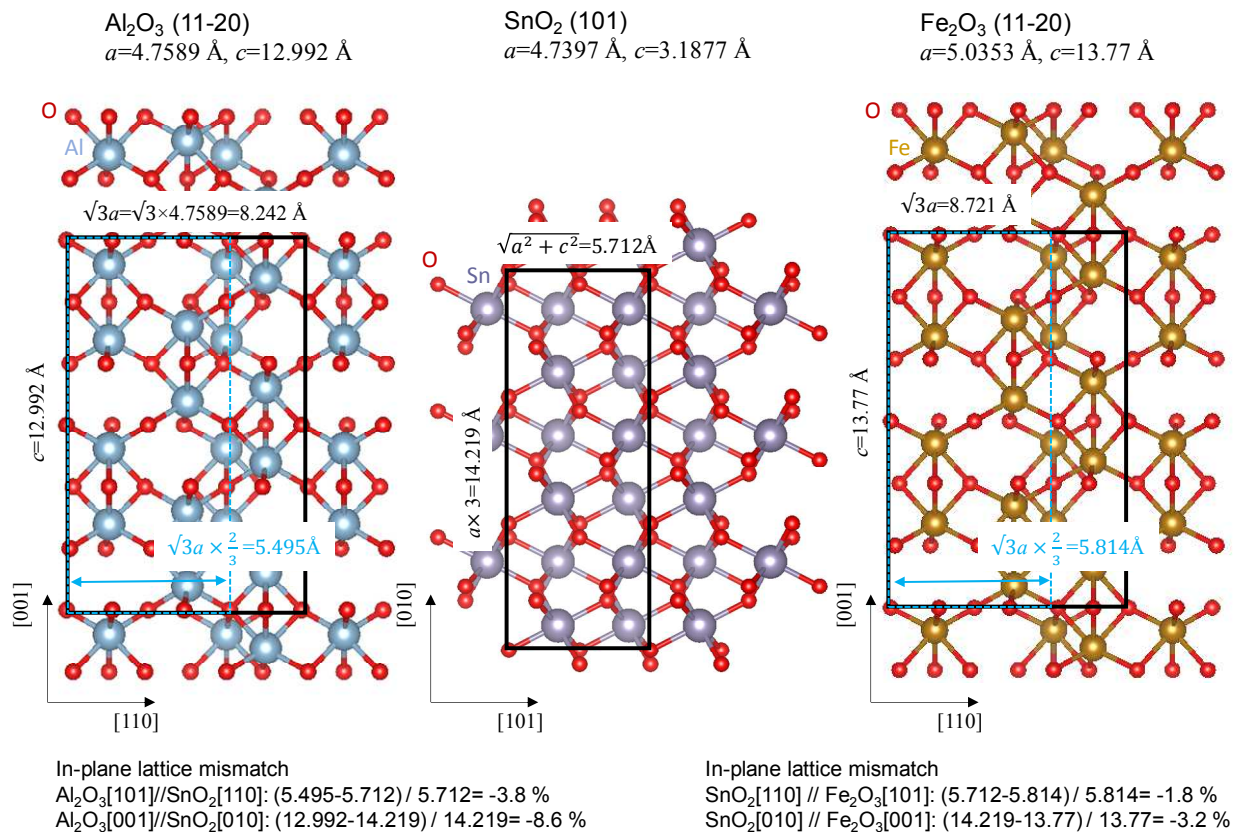


Figure S5. Calculation of lattice mismatch between each crystal.

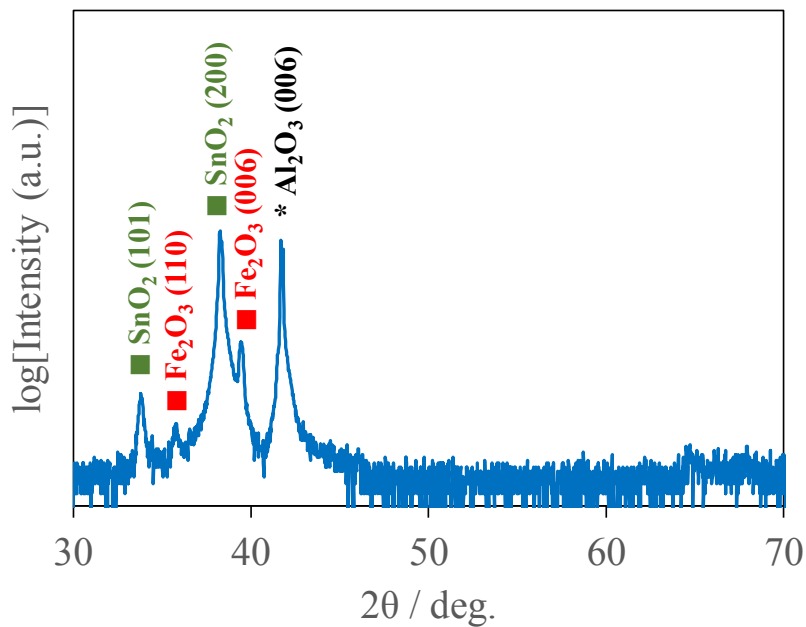


Figure S6. XRD patterns of the (001) oriented Fe_2O_3 film.

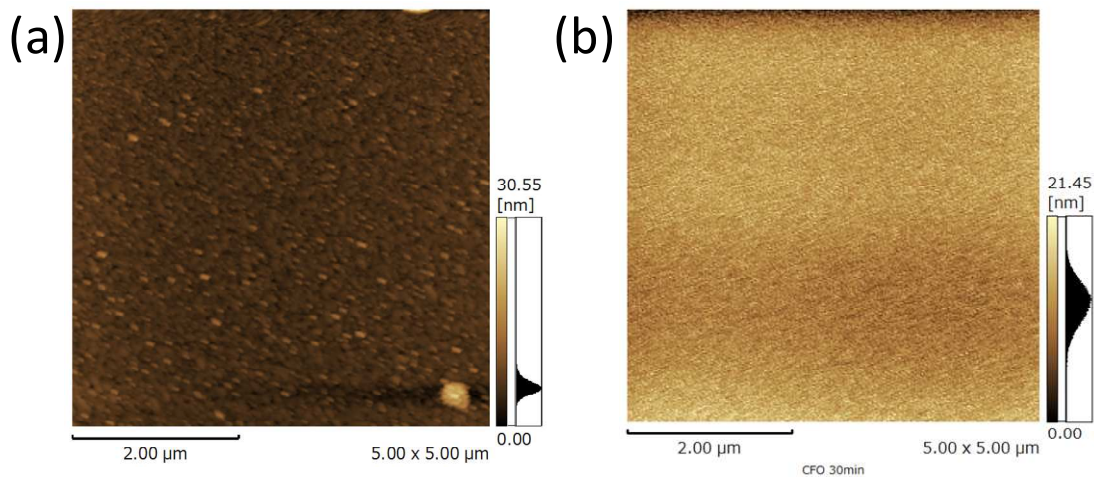


Figure S7. AFM images on the surfaces of $\alpha\text{-Fe}_2\text{O}_3$ (a) and CaFe_2O_4 (b) films. Roughness factors R_a (arithmetic average of the absolute values of the height profile) for the surfaces of $\alpha\text{-Fe}_2\text{O}_3$ and CaFe_2O_4 films were 1.71 nm and 1.23 nm, respectively.

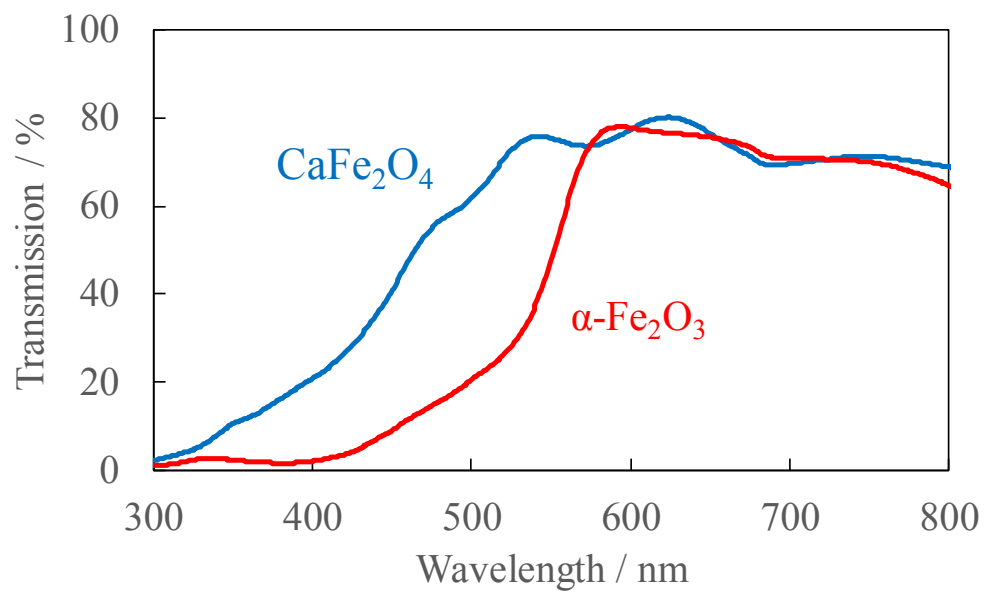


Figure S8. Optical transmission spectra of 100 nm-thick α -Fe₂O₃ and CaFe₂O₄ thin films.

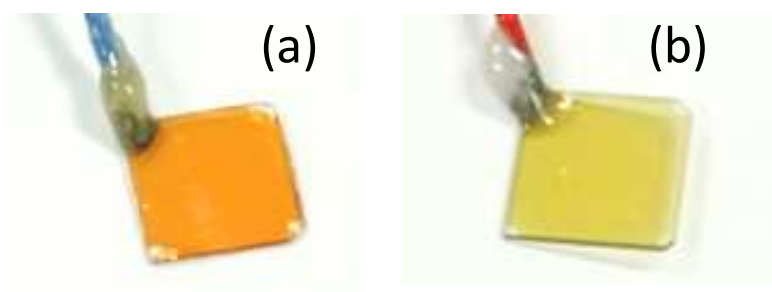


Figure S9. Photographs of α -Fe₂O₃ film (a) and CaFe₂O₄ film (b). The size of these electrodes was 1 cm².

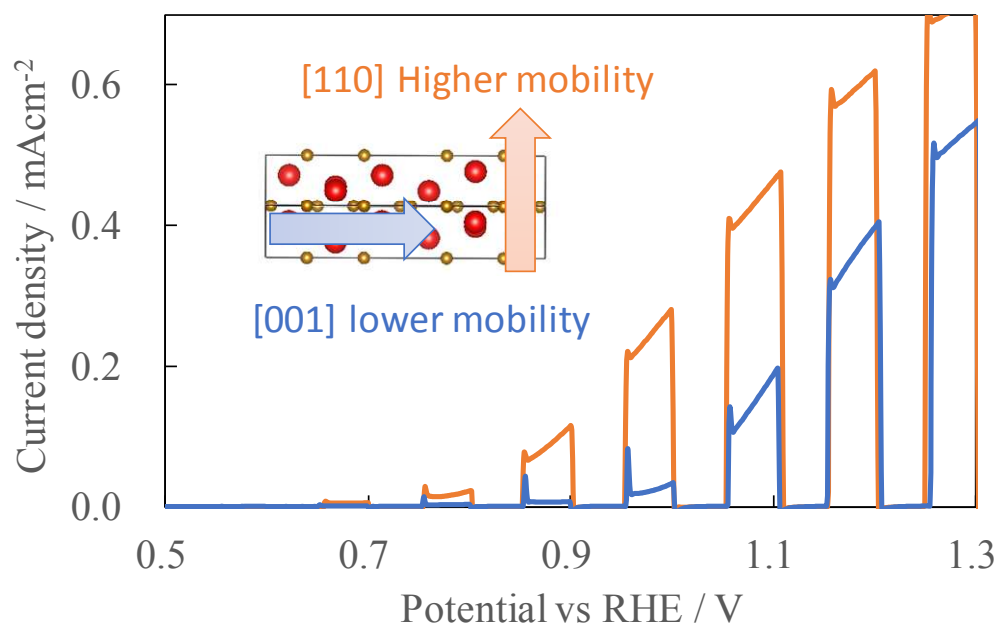


Figure S10. Photocurrent property of (110) and (001) oriented $\alpha\text{-Fe}_2\text{O}_3$ thin films.

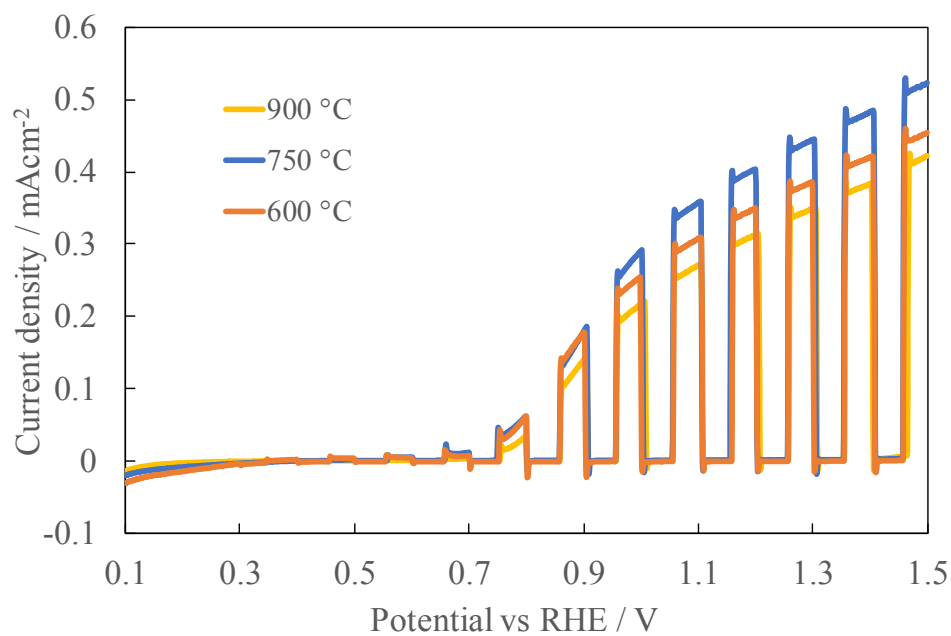


Figure S11. Photocurrent properties of $\alpha\text{-Fe}_2\text{O}_3$ thin films synthesized through various annealing temperature conditions.

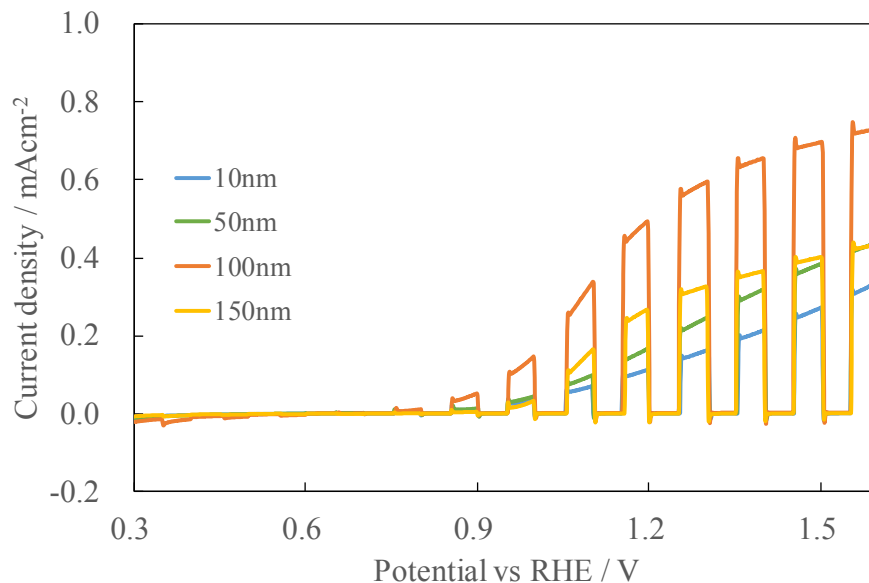


Figure S12. Photocurrent properties of α -Fe₂O₃ thin films with various α -Fe₂O₃ thickness.

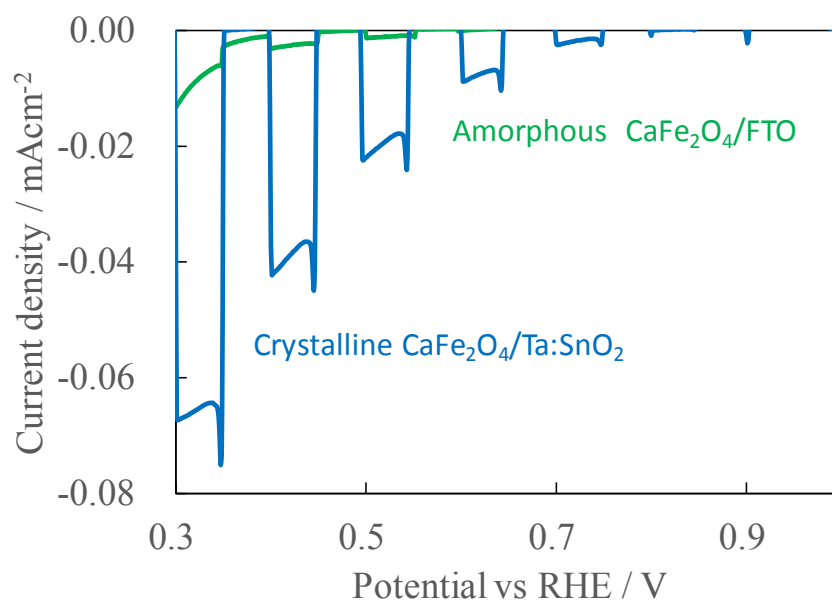


Figure S13. Photocurrent properties of crystalline CaFe₂O₄/Ta:SnO₂ and amorphous CaFe₂O₄/FTO films. Amorphous CaFe₂O₄ film was coated on a commercial fluorine-doped SnO₂ (FTO) glass substrate as a control group.

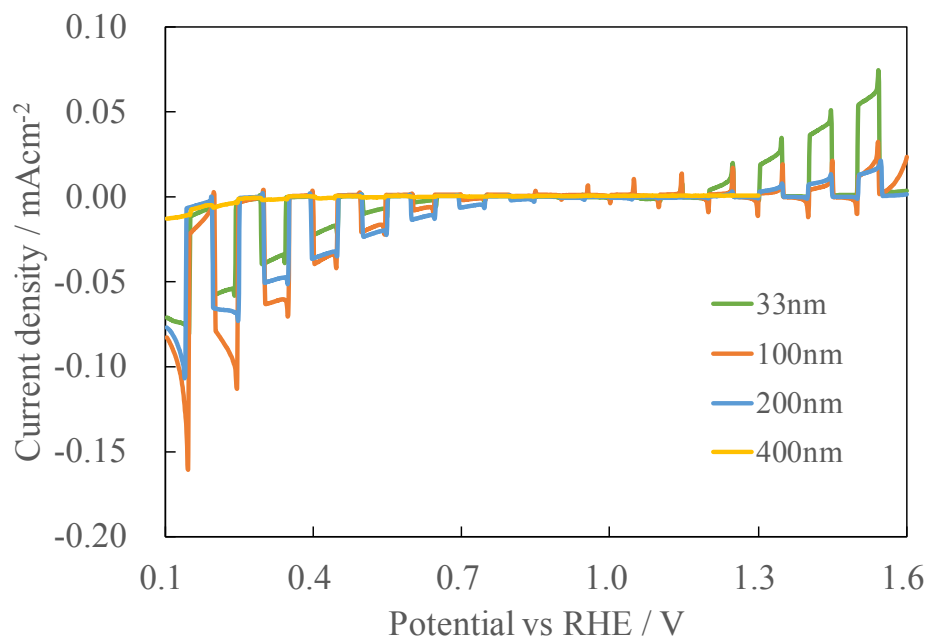


Figure S14. Photocurrent properties of CaFe_2O_4 thin films with various thicknesses.

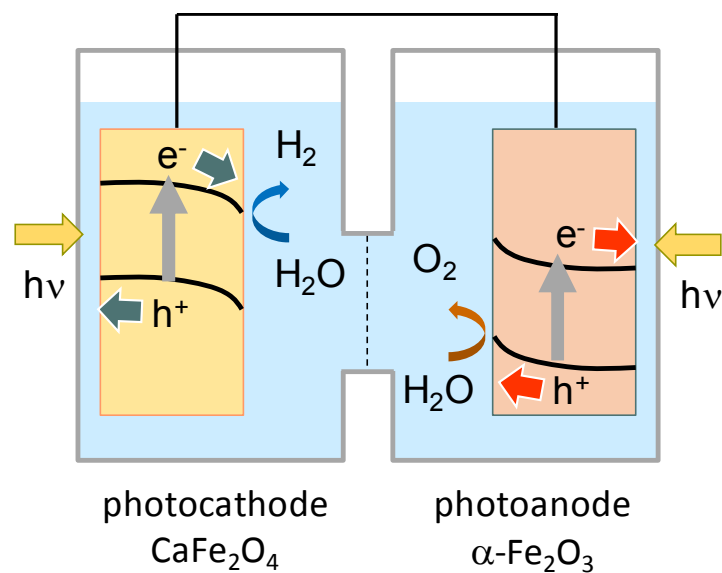


Figure S15. Experimental setup for the evaluation of the Z-scheme system.