

Supplementary Information

Amorphous Ta₂O₅-supported Ru as an efficient electrocatalyst for selective hydrogenation of cinnamaldehyde with water as the hydrogen source

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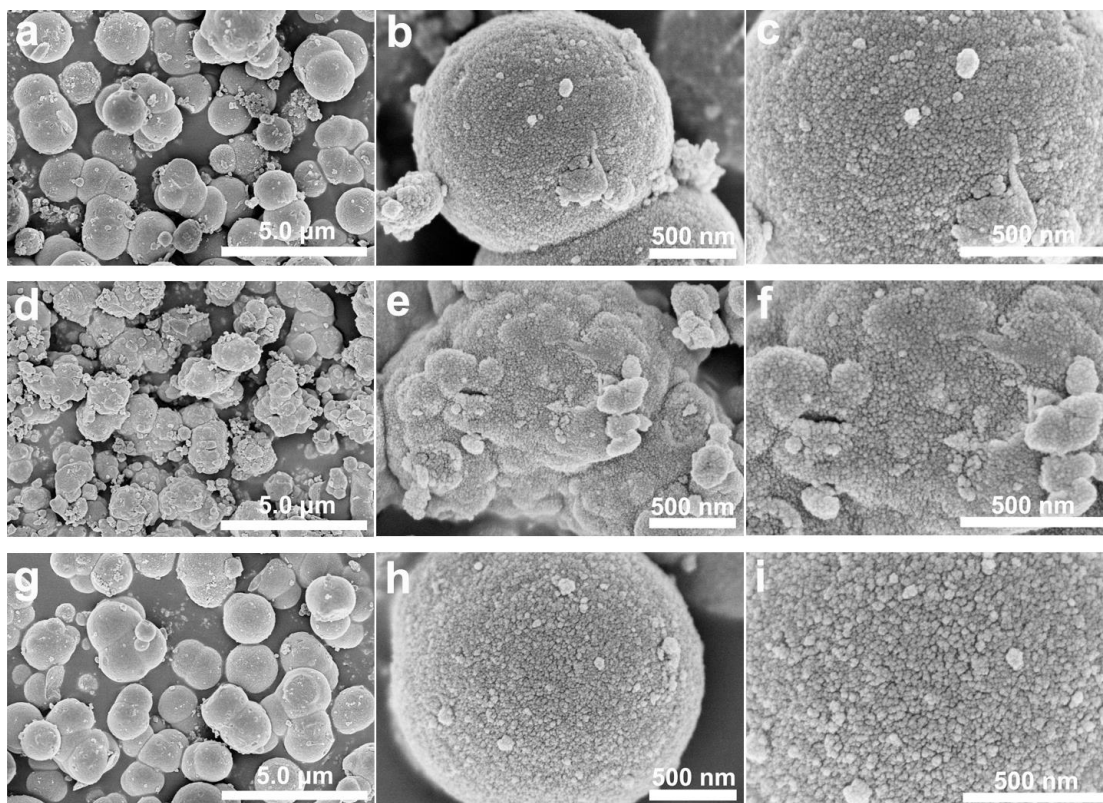


Fig. S1 SEM images of samples under different magnification: (a-c) Ta₂O₅; (d-f) Ta₂O₅/Ru-4.0; (g-i) Ta₂O₅-400.

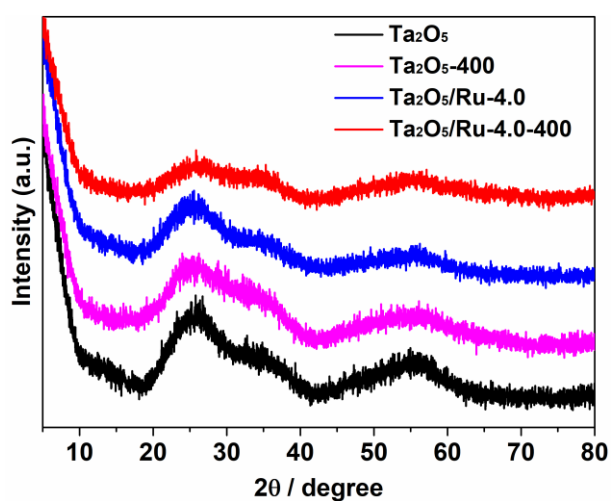


Fig. S2 XRD patterns of Ta₂O₅, Ta₂O₅-400, Ta₂O₅/Ru-4.0 and Ta₂O₅/Ru-4.0-400.

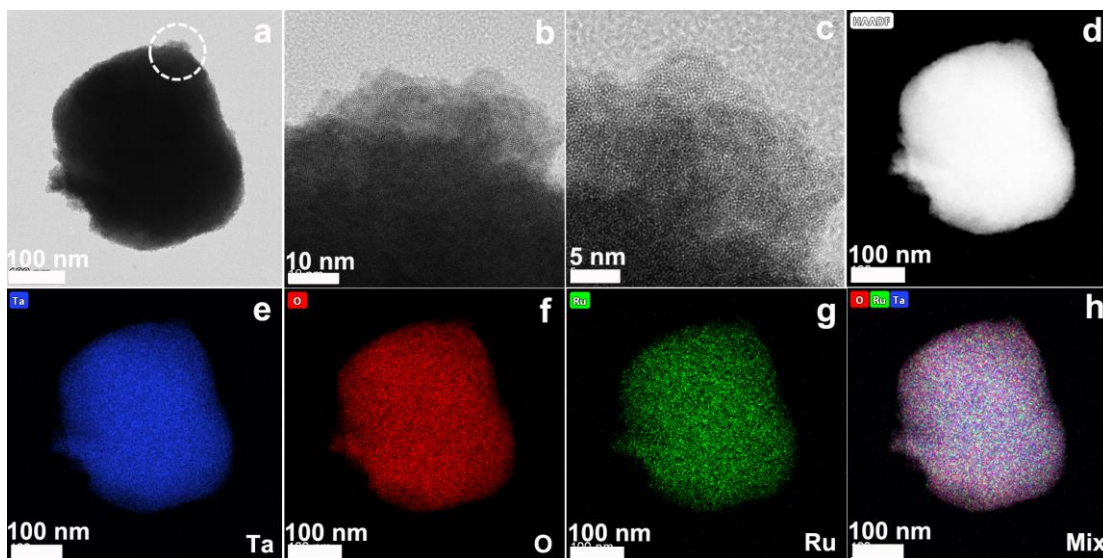


Fig. S3 Ta₂O₅/Ru-4.0: (a) TEM image; (b)(c) HRTEM images; (d-h) High-angle annular dark-field scanning transmission electron microscopy (HAADF-STEM) and corresponding elemental mapping images.

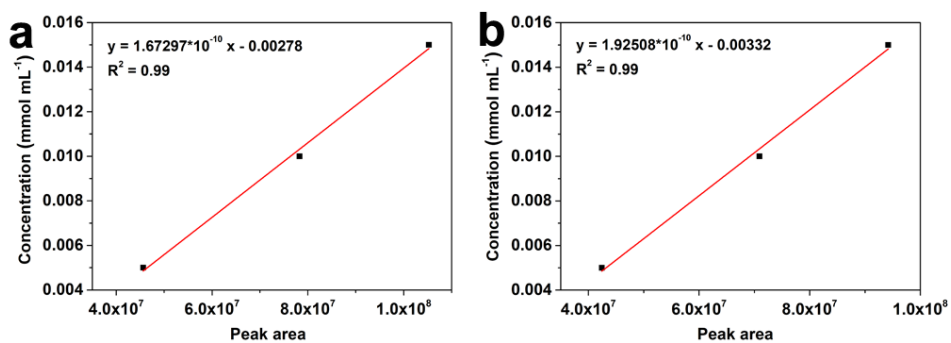


Fig. S4 Gas chromatograph spectrogram and the corresponding calibration curves of (a) CAL and (b) HCAL.

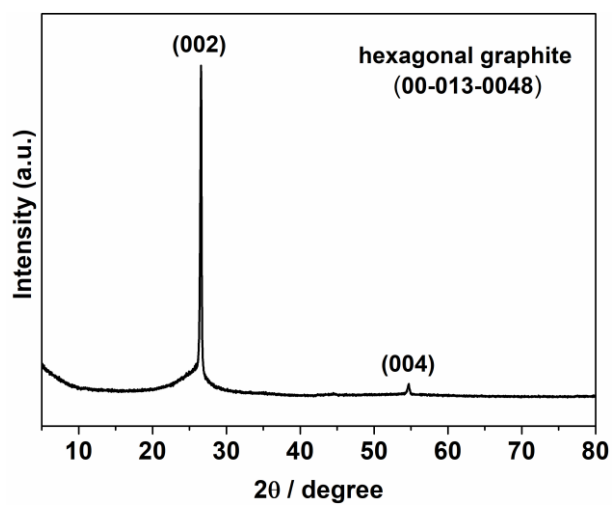


Fig. S5 XRD pattern of Ta₂O₅/Ru-4.0-400 after ECH measurement in 0.1 M PBS electrolyte.

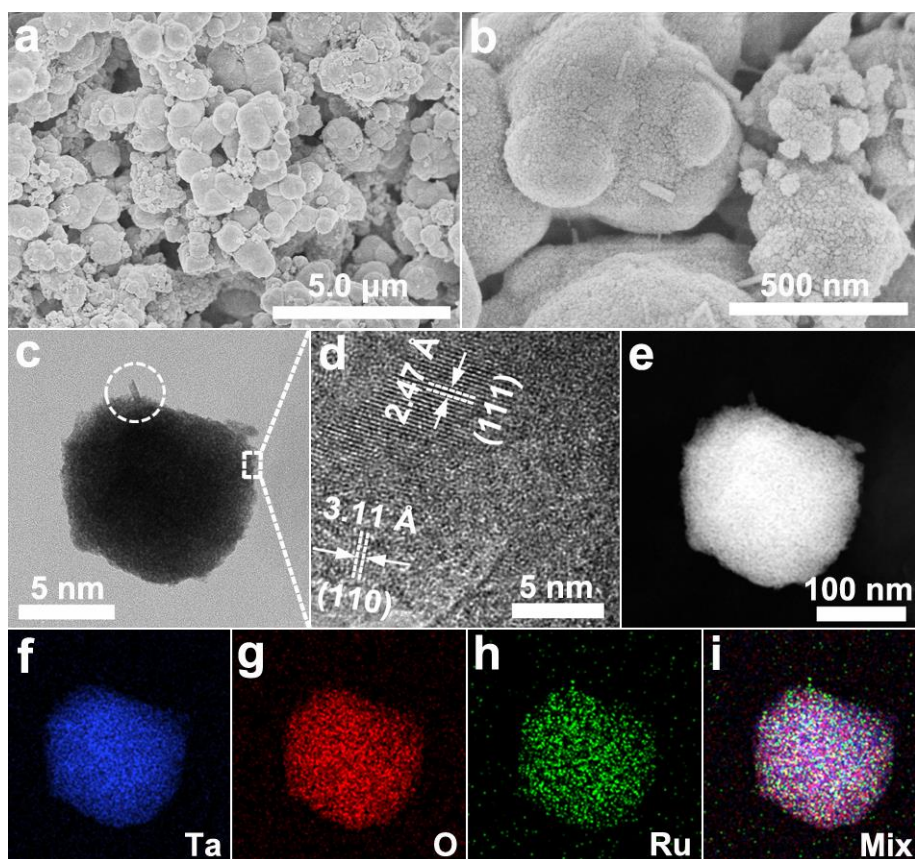


Fig. S6 Ta₂O₅/Ru-4.0-400 after ECH measurement in 0.1 M PBS electrolyte: (a) Low-magnification SEM image; (b) High-magnification SEM image; (c) TEM image; (d) HRTEM image; (e) High-angle annular dark-field scanning transmission electron microscopy (HAADF-STEM) and (f-i) corresponding elemental mapping images.

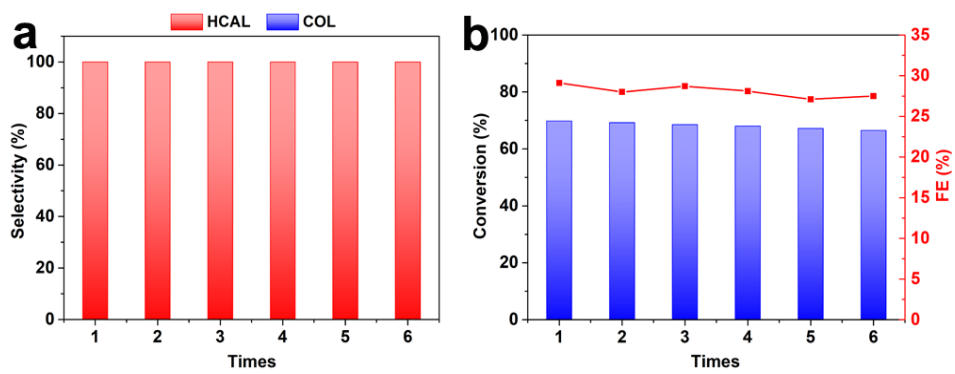


Fig. S7 The six consecutive cycling tests of Ta₂O₅/Ru-4.0-400.

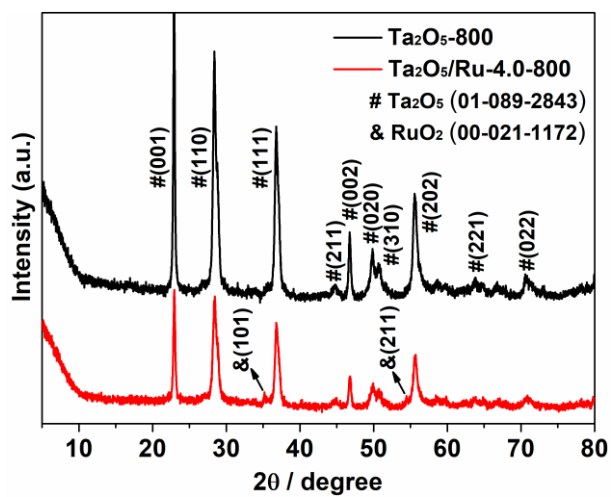


Fig. S8 XRD patterns of Ta₂O₅-800 and Ta₂O₅/Ru-4.0-800.

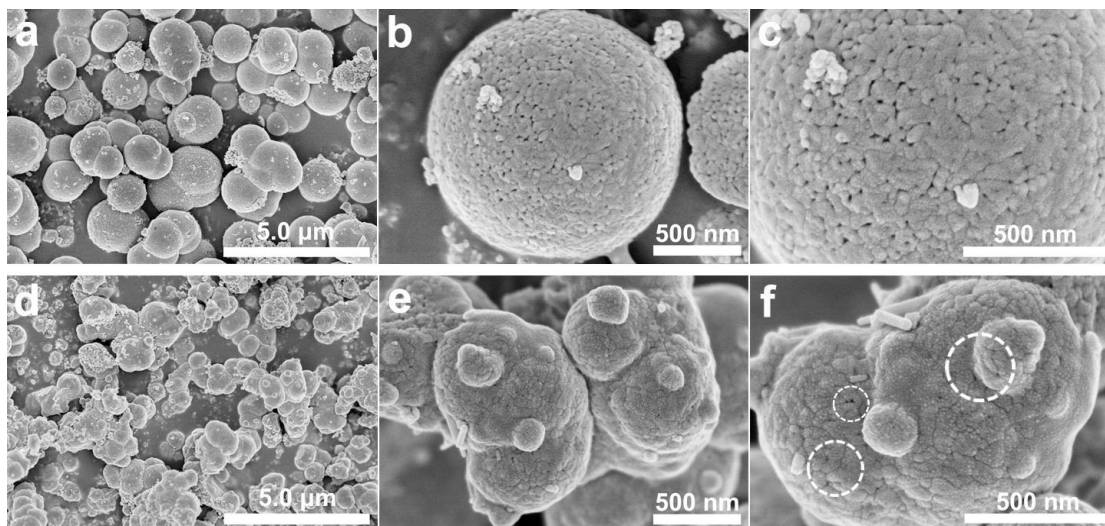


Fig. S9 SEM images of samples under different magnification: (a-c) Ta₂O₅-800; (d-f) Ta₂O₅/Ru-4.0-800.

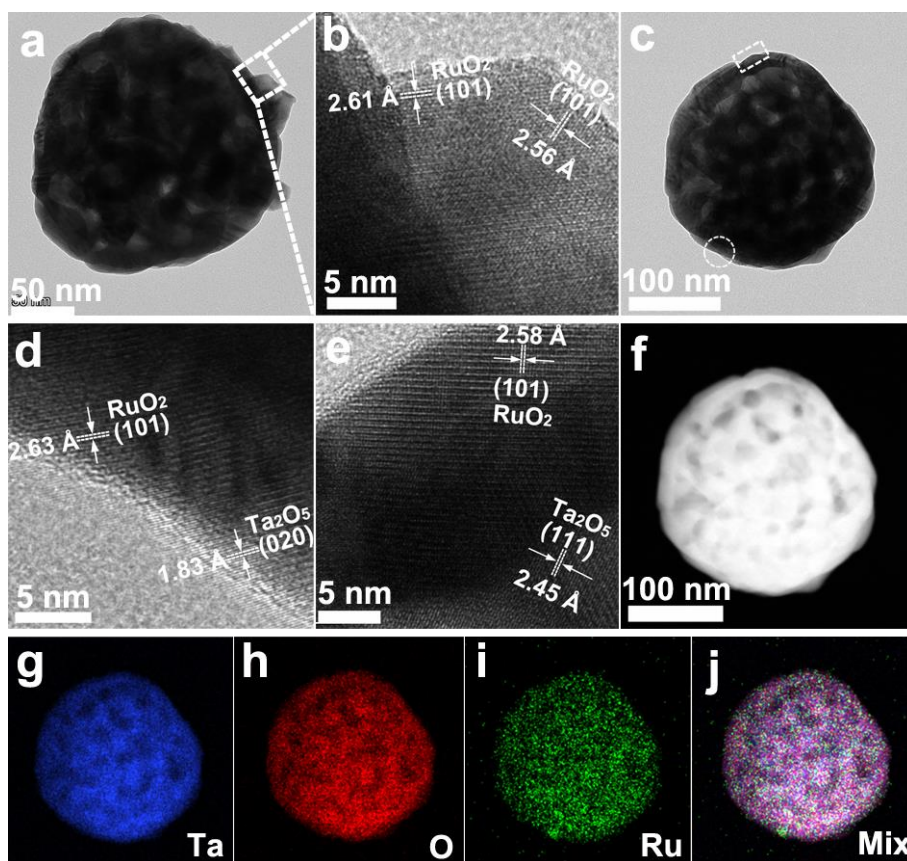


Fig. S10 $\text{Ta}_2\text{O}_5/\text{Ru}$ -4.0-800: (a) TEM image; (b) HRTEM image; (c) TEM image; (d)(e) HRTEM images; (f) High-angle annular dark-field scanning transmission electron microscopy (HAADF-STEM) and (g-j) corresponding elemental mapping images.

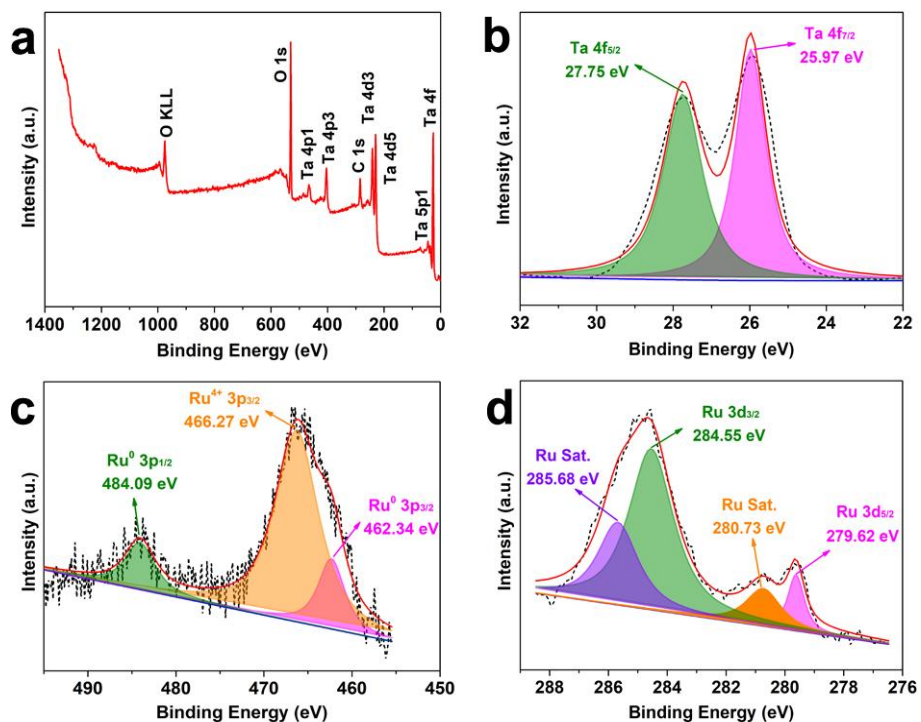


Fig. S11 (a) Surface survey XPS spectra of Ta₂O₅/Ru-4.0-800; High-resolution XPS spectrum of (b) Ta 4f, (c) Ru 3p and (d) Ru 3d.

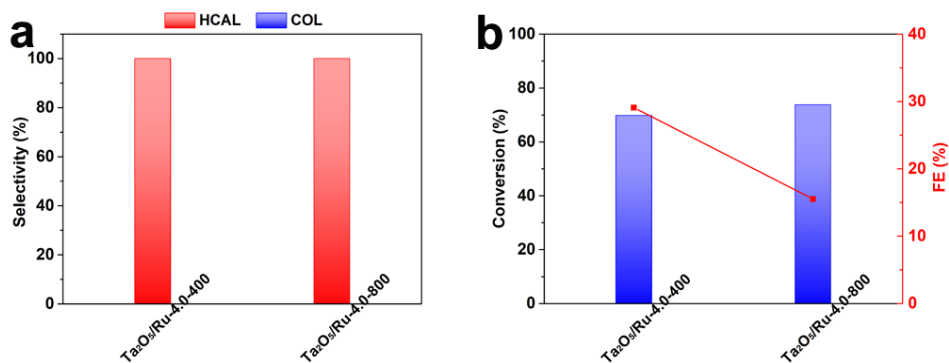


Fig. S12 Effect of the annealing treatment temperature of Ta₂O₅/Ru-4.0 on electrocatalytic CAL hydrogenation under -1.1 V vs. RHE: (a) selectivity, (b) conversion and FE.

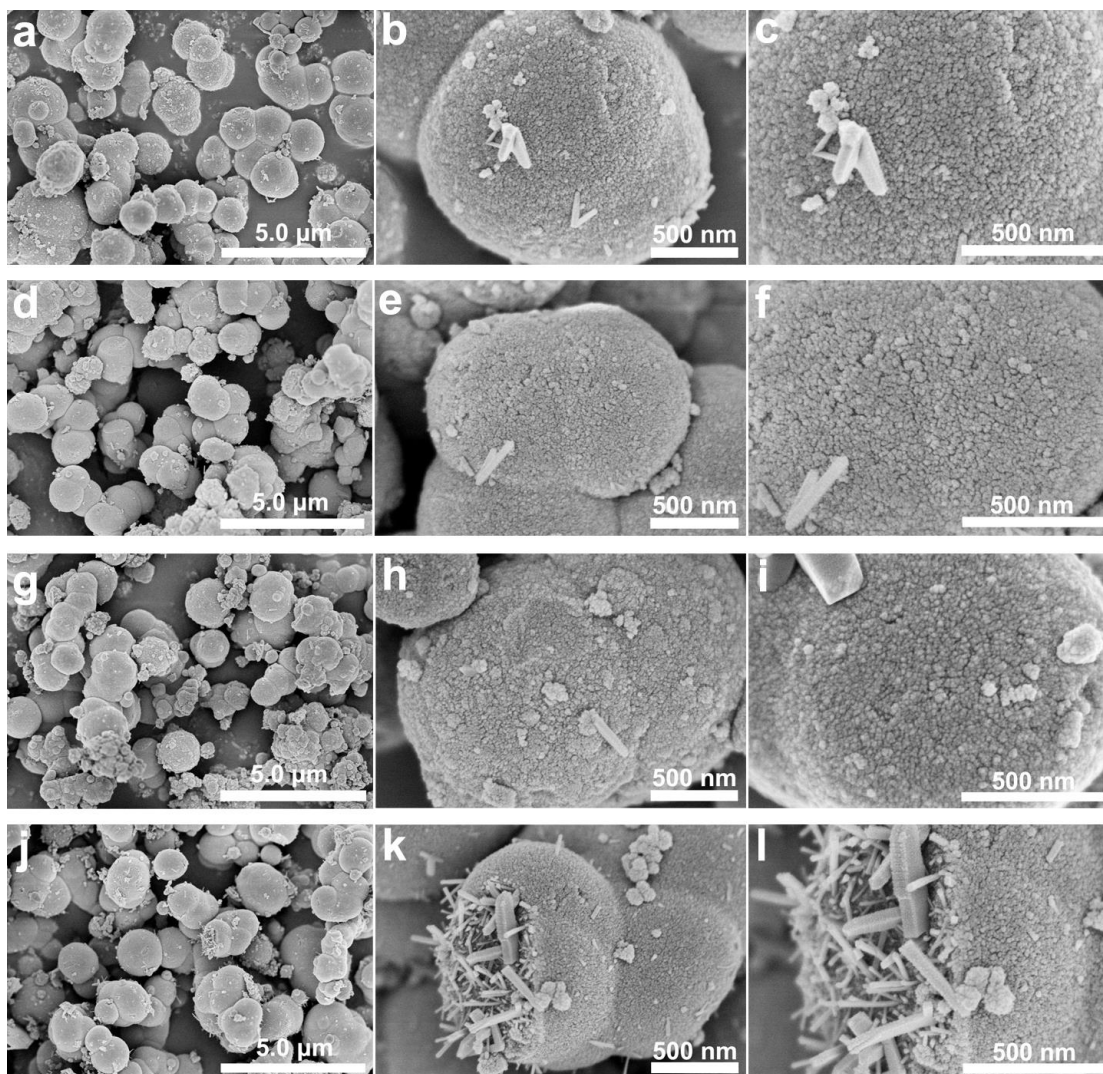


Fig. S13 SEM images of samples under different magnification: (a-c) $\text{Ta}_2\text{O}_5/\text{Ru}-1.0-400$; (d-f) $\text{Ta}_2\text{O}_5/\text{Ru}-2.0-400$; (g-i) $\text{Ta}_2\text{O}_5/\text{Ru}-3.0-400$; (j-l) $\text{Ta}_2\text{O}_5/\text{Ru}-5.0-400$.

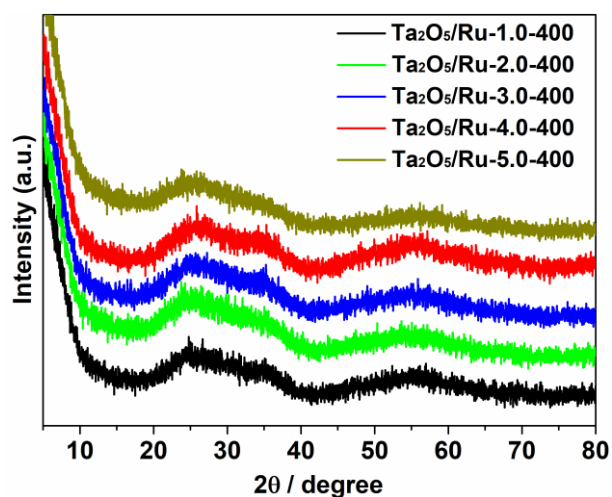


Fig. S14 XRD patterns of Ta₂O₅/Ru-1.0-400, Ta₂O₅/Ru-2.0-400, Ta₂O₅/Ru-3.0-400, Ta₂O₅/Ru-4.0-400, and Ta₂O₅/Ru-5.0-400.

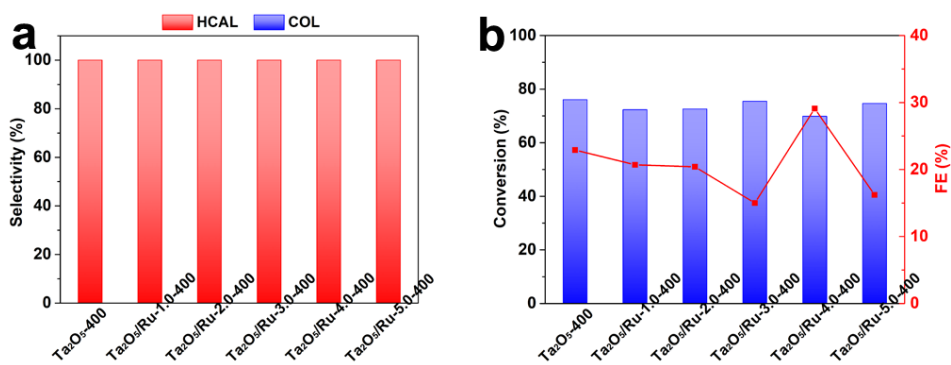


Fig. S15 Effect of the content of Ru on electrocatalytic CAL hydrogenation under -1.1 V vs. RHE: (a) selectivity, (b) conversion and FE.