

Supporting Information

Copper-foam supported Ag microstructure for electrochemical oxidative dehydrogenation of biomass-based furfural and 5-hydroxymethylfurfural

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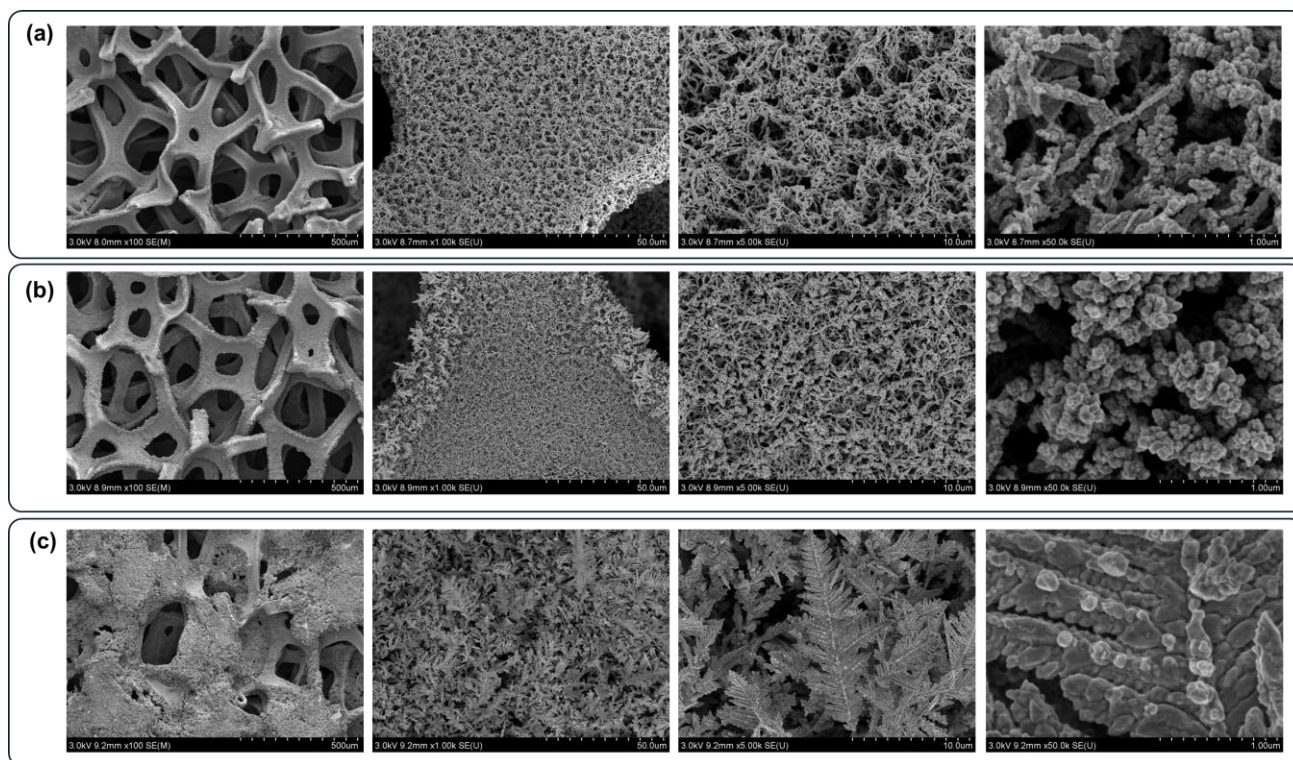


Figure S1. SEM images of (a) Ag₅-Cu/CF, (b) Ag₂₀-Cu/CF and (c) Ag₁₀₀-Cu/CF.

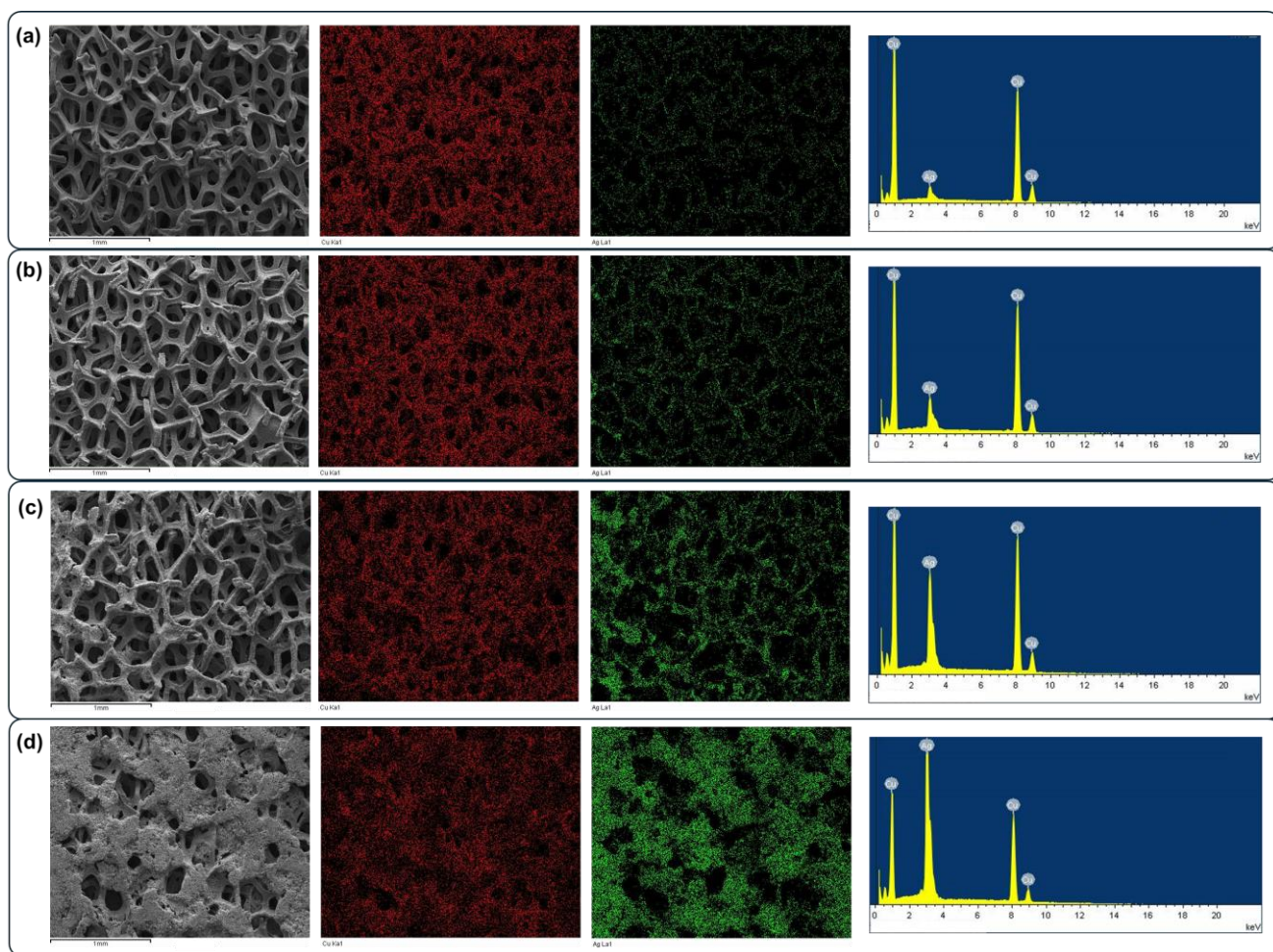


Figure S2. EDS mapping and spectrum of (a) Ag₅-Cu/CF, (b) Ag₂₀-Cu/CF, (c) Ag₅₀-Cu/CF and (d) Ag₁₀₀-Cu/CF.

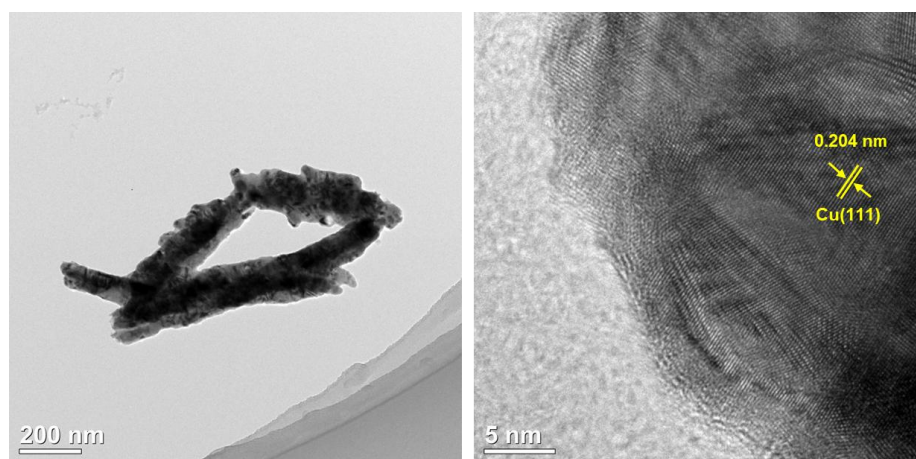


Figure S3. TEM images of Cu/CF.

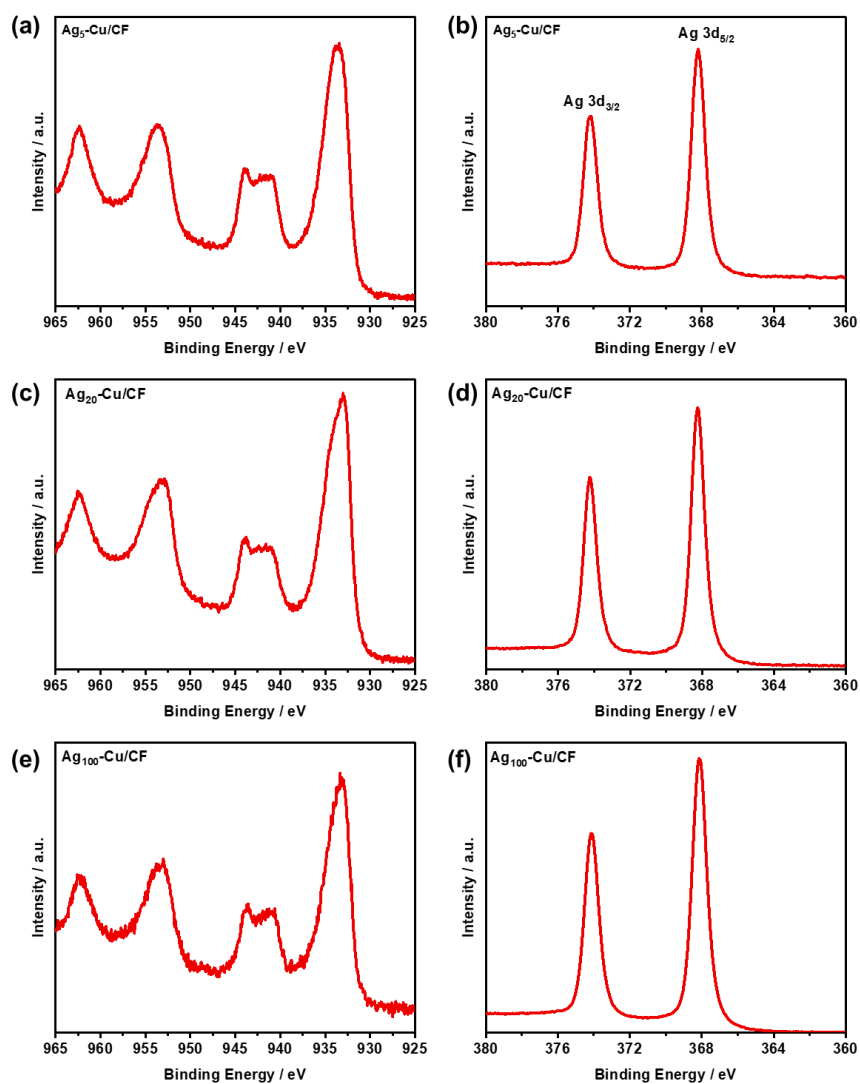


Figure S4. Cu 2p XPS spectra of (a) Ag₅-Cu/CF, (c) Ag₂₀-Cu/CF and (e) Ag₁₀₀-Cu/CF. Ag 3d XPS spectra of (b) Ag₅-Cu/CF, (d) Ag₂₀-Cu/CF and (f) Ag₁₀₀-Cu/CF.

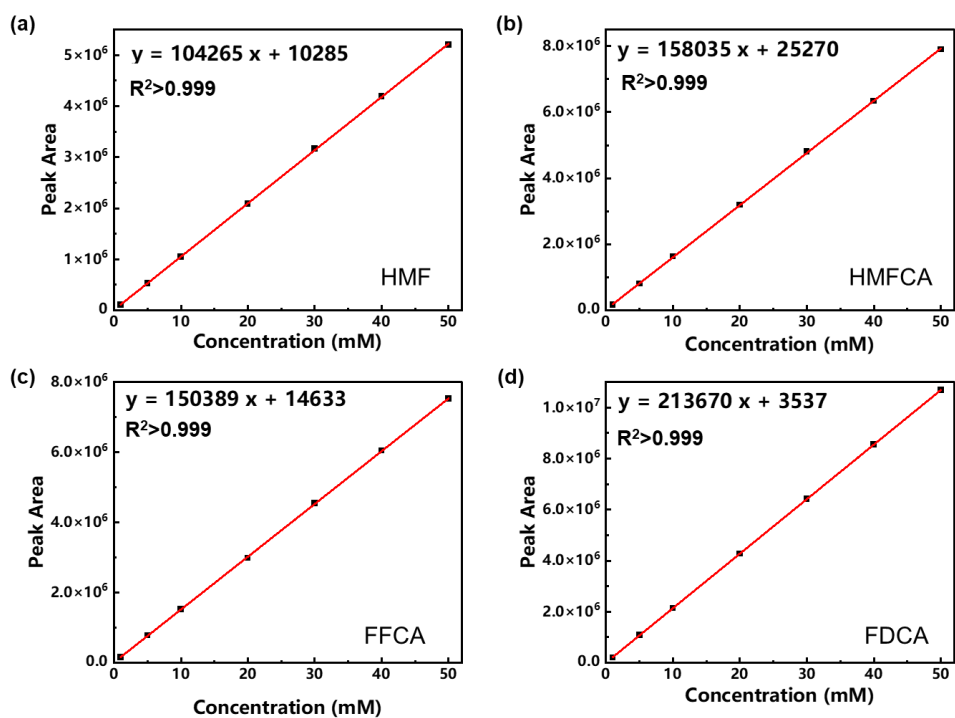


Figure S5. Standard curves of HMF, HMFCA, FFCA and FDCA.

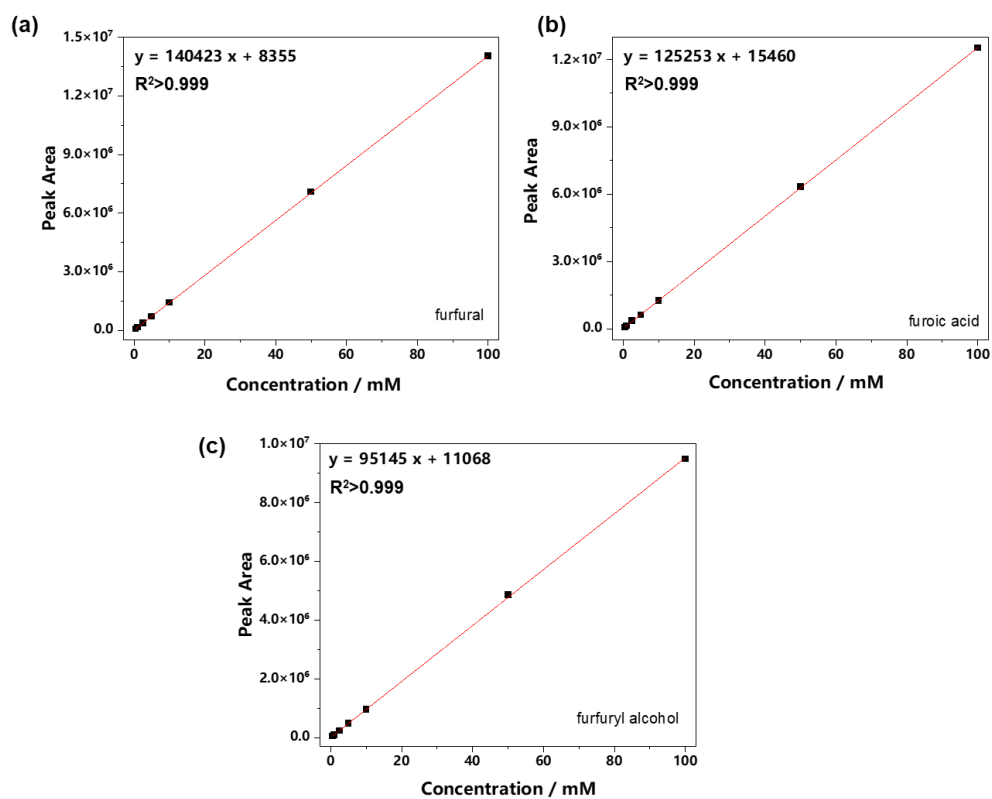


Figure S6. Standard curves of furfural, furoic acid and furfuryl alcohol.

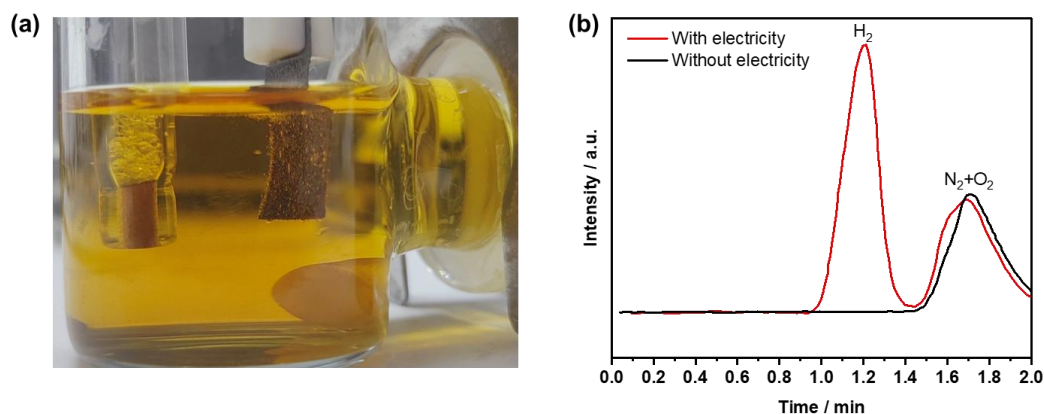


Figure S7. (a) Photograph of Ag₅₀-Cu/CF electrode during electrochemical oxidative dehydrogenation of FF. (b) GC chromatograms of the gas above Ag₅₀-Cu/CF electrode under different conditions. The retention time of H₂ was around 1.2 min.

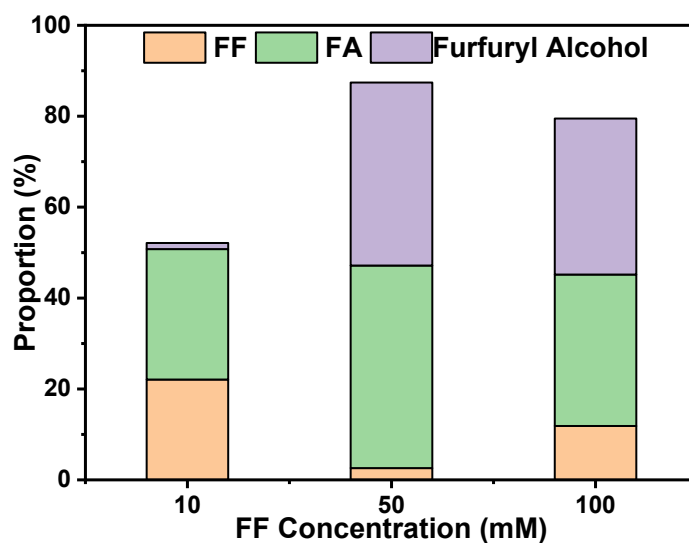


Figure S8. The compound proportion by placing Ag₅₀-Cu/CF electrode in 1 M KOH solution (10 mL) of FF with different concentrations for three hours.

By placing Ag₅₀-Cu/CF electrode in 1 M KOH solution (10 mL) of FF with 50 mM FF or 100 mM FF for three hours, nearly identical concentration of furfuryl alcohol and FA are generated, demonstrating the presence of Cannizzaro reaction ($2\text{FF} + \text{H}_2\text{O} \rightarrow \text{FA} + \text{furfuryl alcohol}$). However, the Cannizzaro reaction is not obvious at low FF concentration of 10 mM.

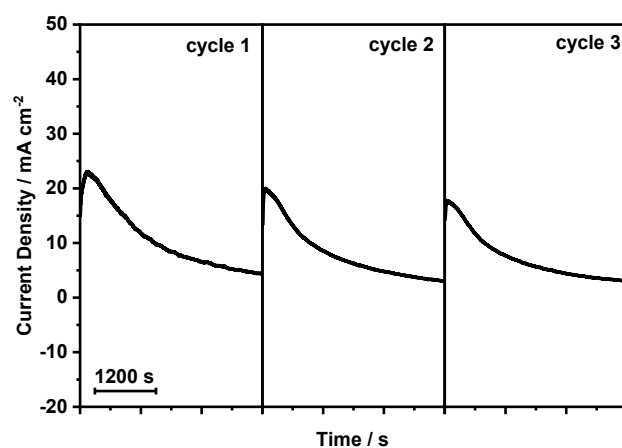


Figure S9. Current change with reaction time in three successive reaction cycles. The testing is performed in 1 M KOH+100 mM FF at 0.4 V.

Table S1. Performance comparison of electrochemical oxidative dehydrogenation of Ag₅₀-Cu/CF with other recently reported electrodes.

Electrode	Reactant /Product	Reaction type	Potential at 10 mA cm ⁻² V	Conversion Rate %	FE %	References
Ag ₅₀ -Cu/CF	FF/FA	electrochemical oxidative dehydrogenation	0.183	94	91	This Work
CuPt _{0.01} NWs/Cu	FF/FA	electrochemical oxidative dehydrogenation	~0.15	n.a.	~90(@0.3 V _{RHE})	Int. J. Hydrogen Energy 2025, 102, 856
CuPt/Cu	FF/FA	electrochemical oxidative dehydrogenation	~0.12	n.a.	~95(@0.4 V _{RHE})	ACS Appl. Mater. Interfaces 2023, 15 (31), 37477
CuAg _{glv} /Cu	FF/FA	electrochemical oxidative dehydrogenation	~0.18	n.a.	~100(@0.4 V _{RHE})	Energy Environ. Sci. 2022, 15, 4175
PdCu	HCHO/HCOOH	electrochemical oxidative dehydrogenation	~0.30	~100	~100	Nat. Commun. 2024, 15 (1), 9852.
CuFe@CF	HCHO/HCOOH	electrochemical oxidative dehydrogenation	~0.25	~100	~100	Adv. Funct. Mater. 2024, 2417545
Pt/CuO@CF	HMF/FD CA	Conventional electro-oxidation	~1.31	~100	~95	Adv. Mater. 2025, 2417684.
CuO–PdO	HMF/FD CA	Conventional electro-oxidation	~1.34	~100	93.7	Adv. Mater. 2022, 34 (42), 2204089
A-Cu-S/CF	HMF/FD CA	Conventional electro-oxidation	~1.50	~100	~90	ChemSusChem 2022, 15 (23), 202201625