Supplemental Information：Salt-Templated Platinum-Copper Porous Macrobeams for Ethanol Oxidation

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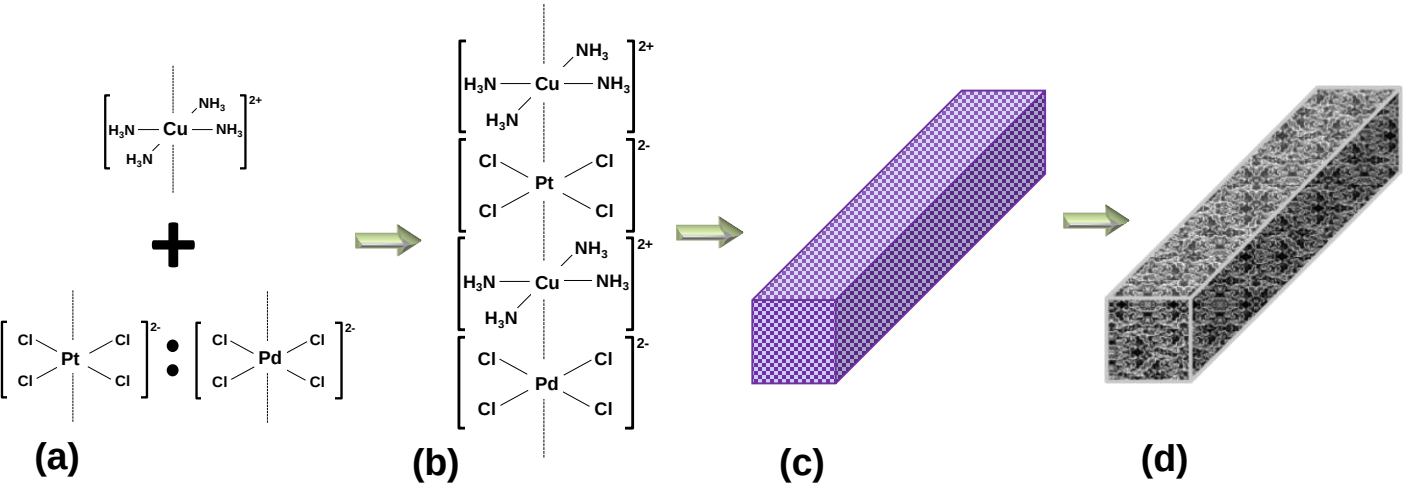

Figure S1. **Macrobeam synthesis scheme**. (**a**) Addition of $[PtCl_4]^{2-}$ and $[PdCl_4]^{2-}$ with $[Cu(NH_3)_4]^{2+}$. (**b**) Linear stacking of platinum and copper square planar complex ions. (**c**) Formation of Magnus's salt crystal derivatives. (**d**) Reduction of platinum/palladium-copper salt needle template to square cross-section macrobeam.

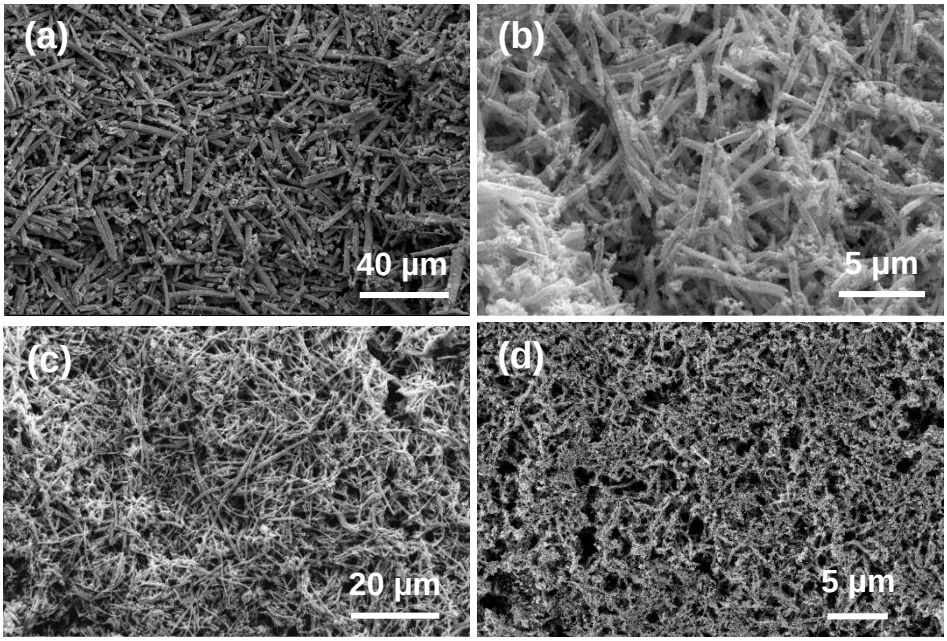

Figure S2. Scanning electron microscope images of copper-platinum macrotube structures from DMAB reduced salts with Pt^{2-}:Pt^{2+}:Cu^{2+} ratios of (**a**) 1:0:1, (**b**) 3:1:2, (**c**) 2:1:1, and (**d**) 1:1:0.

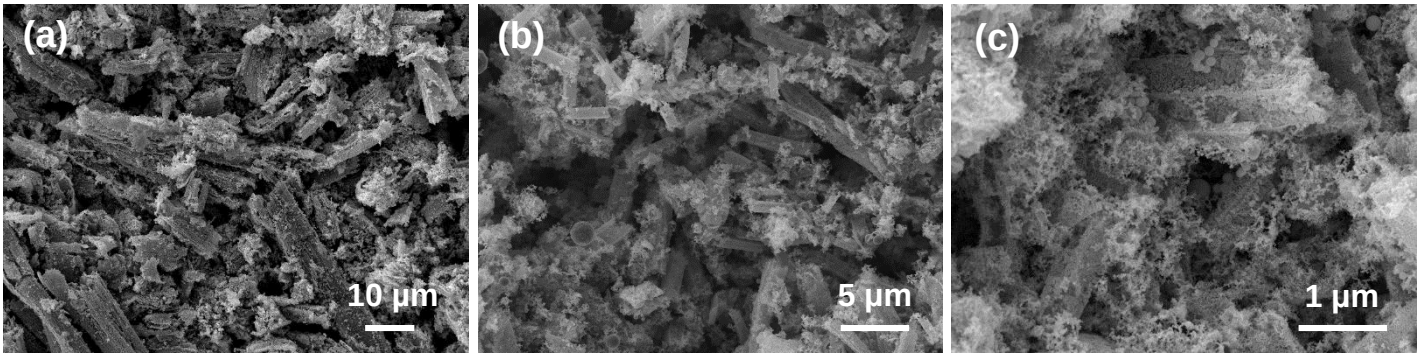

Figure S3. Scanning electron microscope images of copper-platinum macrobeam structures from $NaBH_4$ reduced salts with Pt^{2-}:Pt^{2+}:Cu^{2+} ratios of (**a**) 1:0:1, (**b**) 3:1:2, and (**c**) 2:1:1.

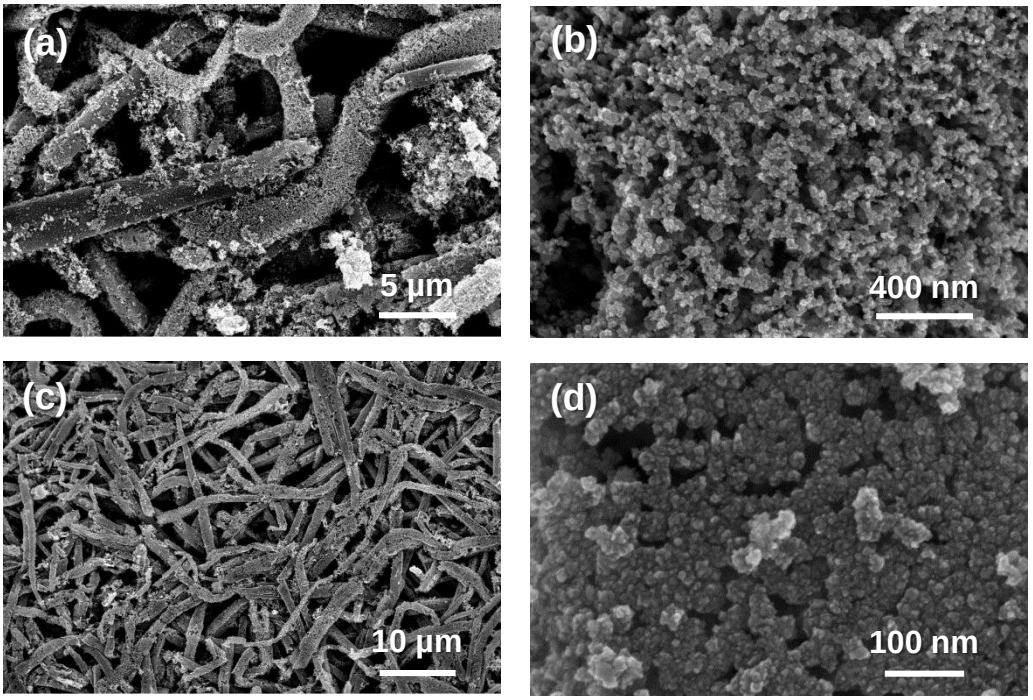

Figure S4. Scanning electron microscope images of platinum-copper macrobeams from DMAB reduced salts with Pt^{2-}:Pd^{2+}:Cu^{2+} ratios of (**a**,**b**) 2:1:1, and (**c**,**d**) 3:1:2.

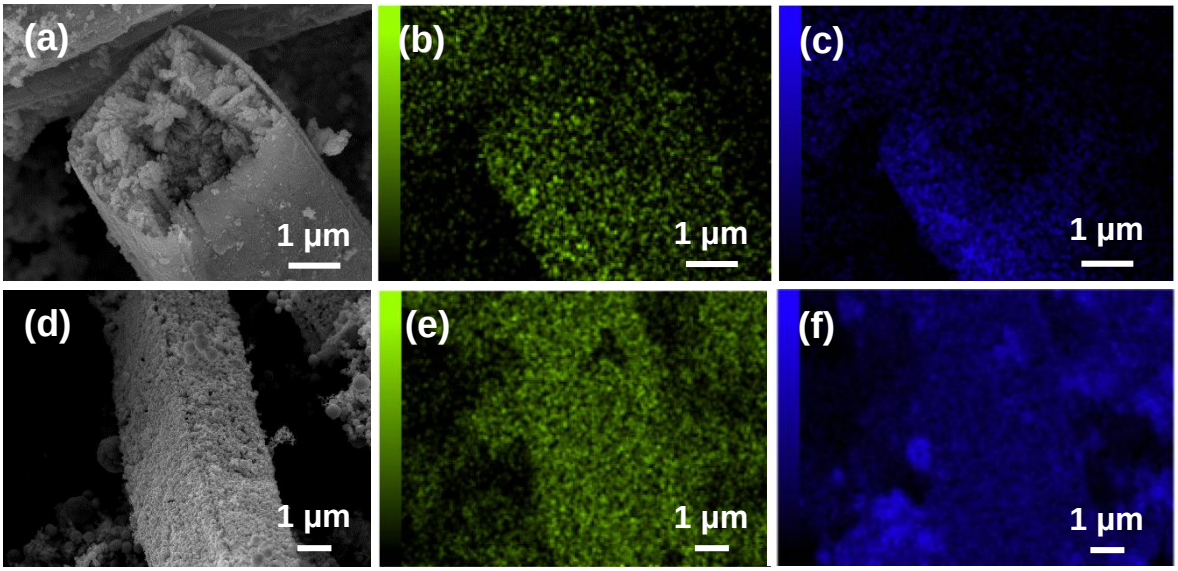

Figure S5. Energy dispersive X-ray spectroscopy mapping of platinum-copper macrobeams from salts with a Pt^{2-}:Pt^{2+}:Cu^{2+} ratio of 1:0:1 reduced with (**a–c**) DMAB and (**d–f**) $NaBH_4$. (**b**,**e**) Cu-K line (green), and (**c**,**f**) Pt-M line (blue) mapped.

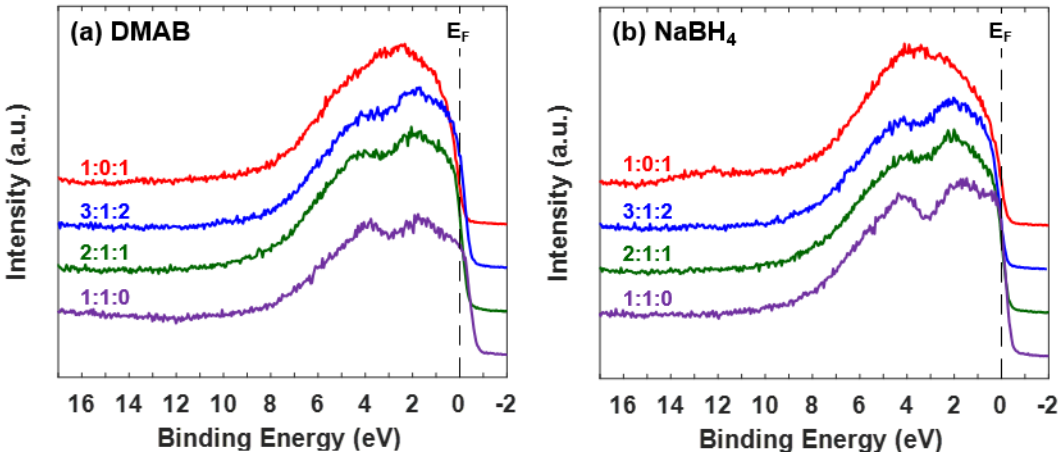

Figure S6. X-ray photoelectron spectra (XPS) valence-band spectra (VBS) of the Pt–Cu macrobeams from (**a**) DMAB, and (**b**) $NaBH_4$ reduced salts with Pt^{2-}:Pt^{2+}:Cu^{2+} ratios of 1:0:1, 3:1:2, 2:1:1, and 1:1:0.

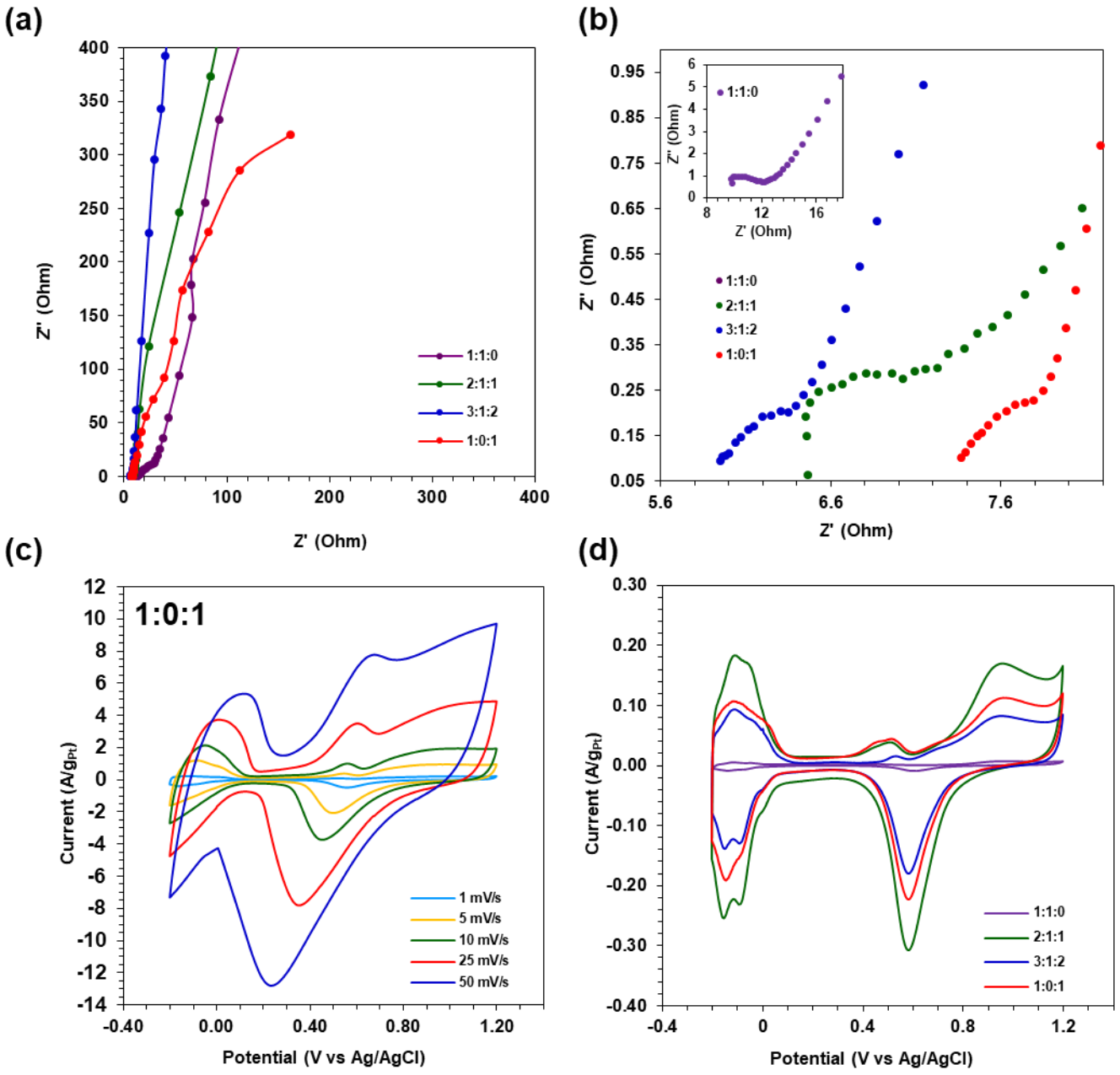

Figure S7. Electrochemical characterization of Pt-Cu macrobeams from Pt^{2-}:Pt^{2+}:Cu^{2+} salts reduced with $NaBH_4$. (**a**) Electrochemical impedance spectroscopy (EIS) in 0.5 M H_2SO_4 at frequency range of 1MHz to 1mHz. (**b**) High frequency EIS from (a); (inset) EIS spectrum for 1:1:0. (**c**) Cyclic voltammetry (CV) in 0.5 M H_2SO_4 for Pt-Cu macrobeams from a 1:0:1 Pt^{2-}:Pt^{2+}:Cu^{2+} salt ratio, in 0.5 M H_2SO_4 for scan rates of 1, 5, 10, 25, and 50 mV/s. (d) CV in 0.5 M H_2SO_4 and 0.5 mV/s scan rate for macrobeams with Pt^{2-}:Pt^{2+}:Cu^{2+} salt ratios of 1:1:0, 2:1:1, 3:1:2, and 1:0:1.

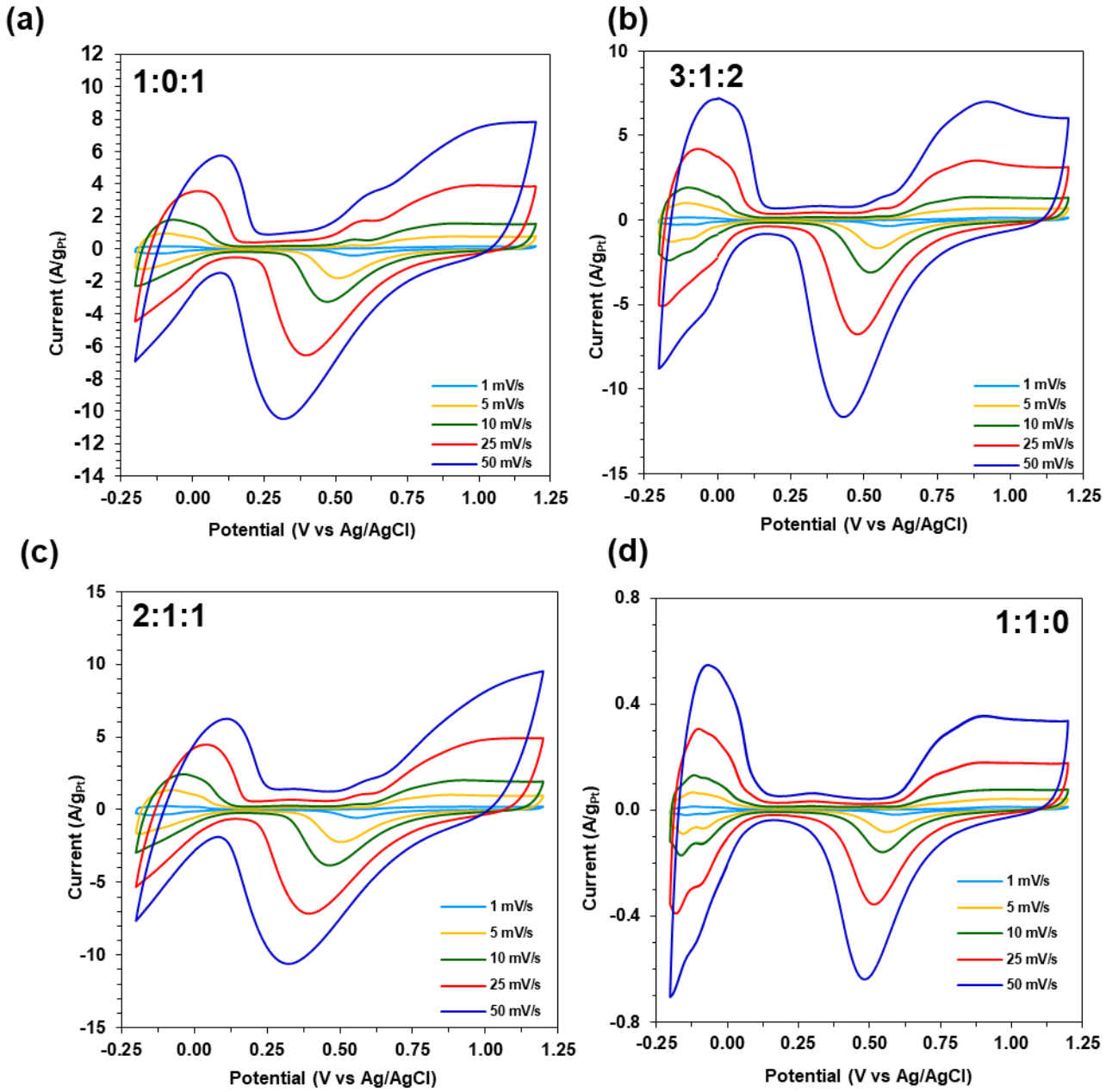

Figure S8. Cyclic voltammetry (CV) curves of platinum-copper macrobeams from DMAB reduced salts with Pt^{2-}:Pt^{2+}:Cu^{2+} ratios of (**a**) 1:0:1, (**b**) 3:1:2, (**c**) 2:1:1, and (**d**) 1:1:0 in 0.5 M H_2SO_4 at scan rates of 1, 5, 10, 25, and 50 mV/s.

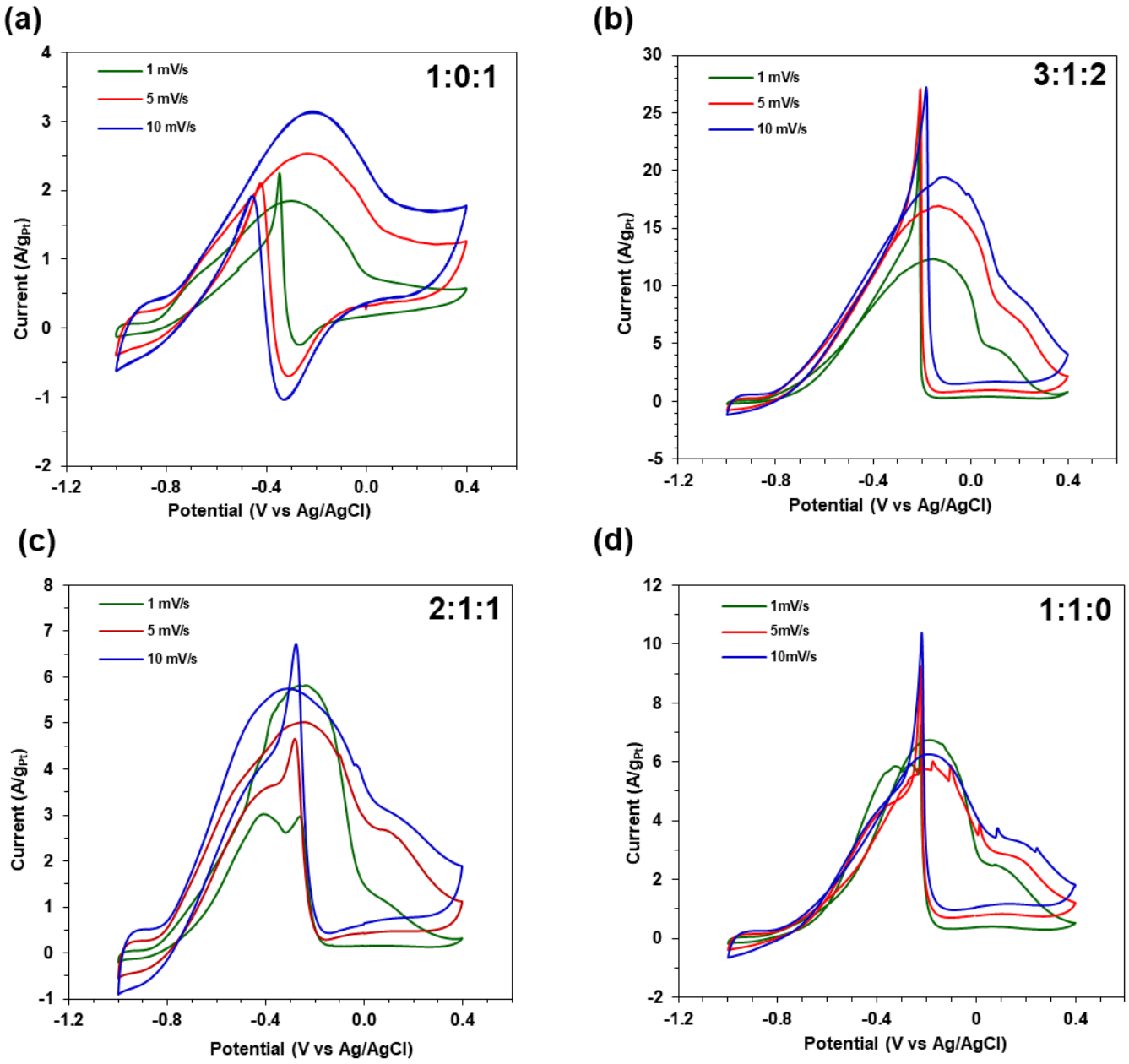

Figure S9. Cyclic voltammetry (CV) curves of platinum-copper macrobeams from DMAB reduced salts with Pt^{2-}:Pt^{2+}:Cu^{2+} ratios of (**a**) 1:0:1, (**b**) 3:1:2, (**c**) 2:1:1, and (**d**) 1:1:0 in 1 M KOH and 1 M ethanol at scan rates of 1, 5, and 10 mV/s.

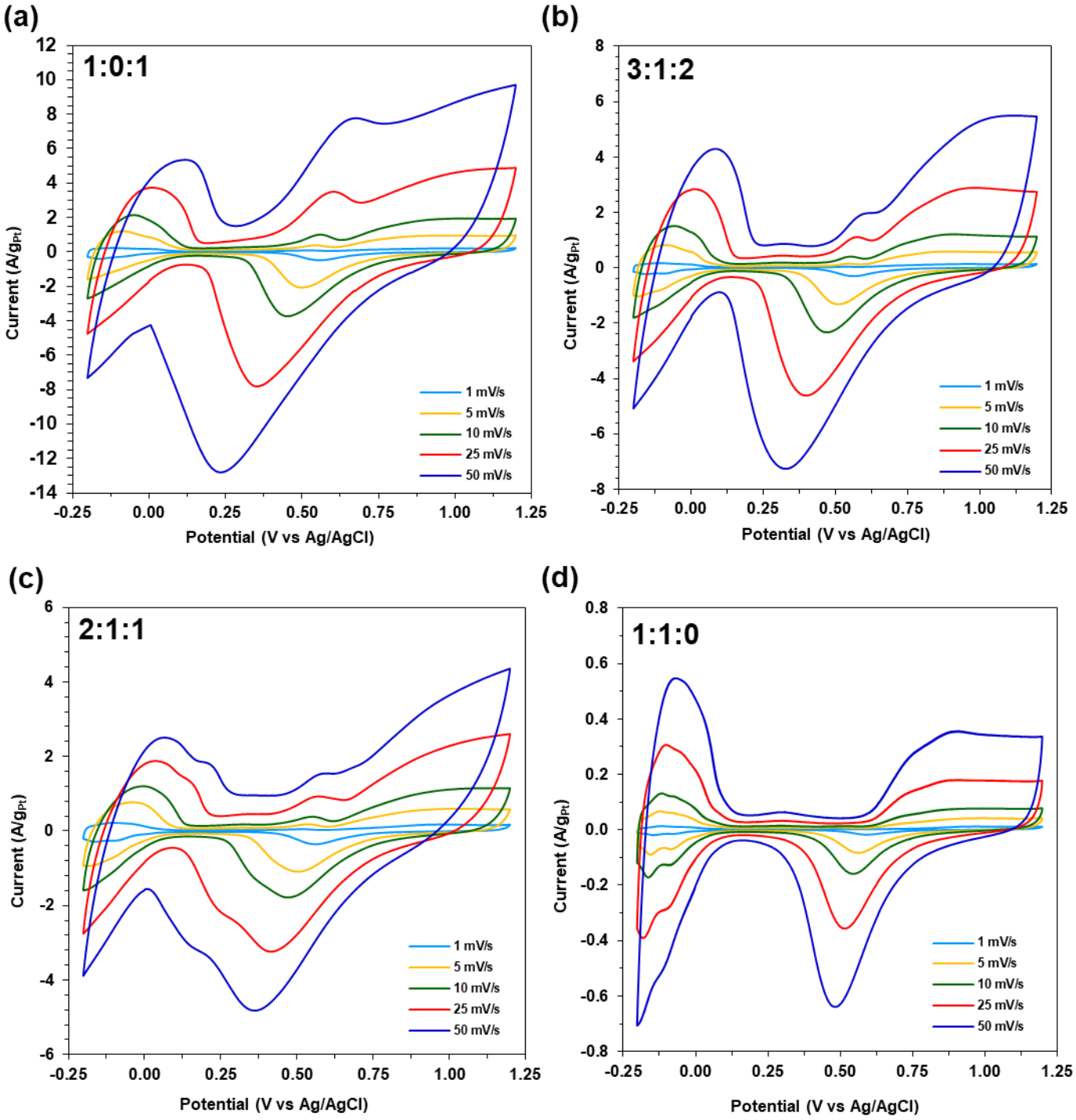

Figure S10. Cyclic voltammetry (CV) curves of platinum-copper macrobeams from $NaBH_4$ reduced salts with Pt^{2-}:Pt^{2+}:Cu^{2+} ratios of (**a**) 1:0:1, (**b**) 3:1:2, (**c**) 2:1:1, and (**d**) 1:1:0 in 0.5 M H_2SO_4 at scan rates of 1, 5, 10, 25, and 50 mV/s.

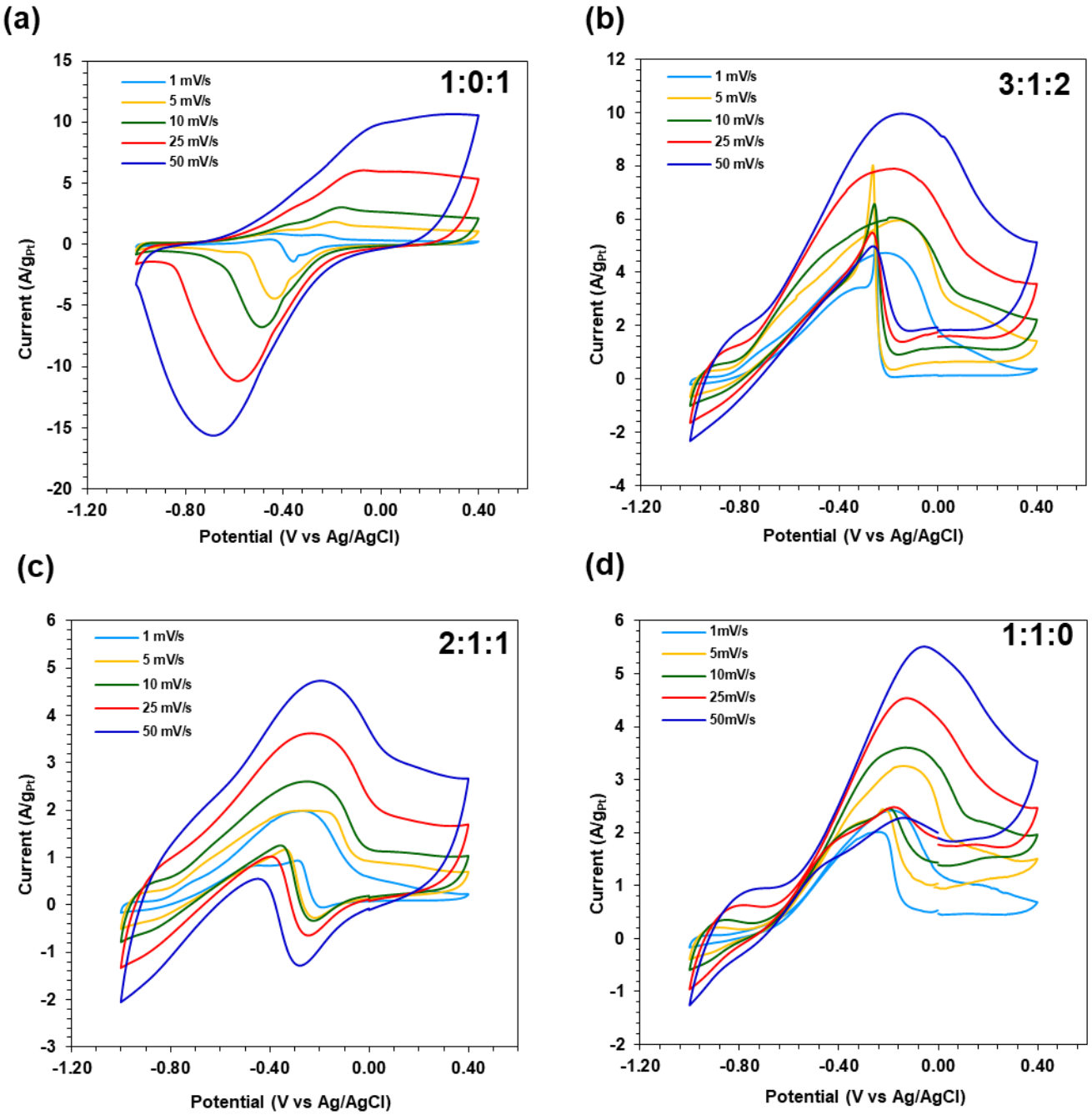

Figure S11. Cyclic voltammetry (CV) curves of platinum-copper macrobeams from $NaBH_4$ reduced salts with Pt^{2-}:Pt^{2+}:Cu^{2+} ratios of (**a**) 1:0:1, (**b**) 3:1:2, (**c**) 2:1:1, and (**d**) 1:1:0 in 1 M KOH and 1 M ethanol at scan rates of 1, 5, 10, 25, and 50 mV/s.