Electronic Supplementary Information

Green Synthesis of Cu Micro/Nanoparticles for Low-Resistivity Cu Thin Films Using Ascorbic Acid in Aqueous Solution

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Content:

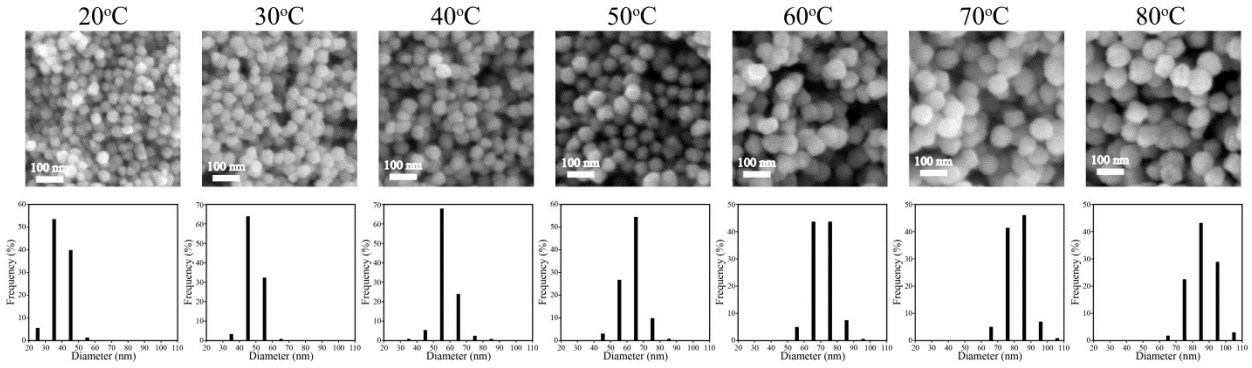

Fig. S1 SEM micrographs and particle size distribution of the Cu NPs synthesized at pH 11.0 and various reaction temperatures.

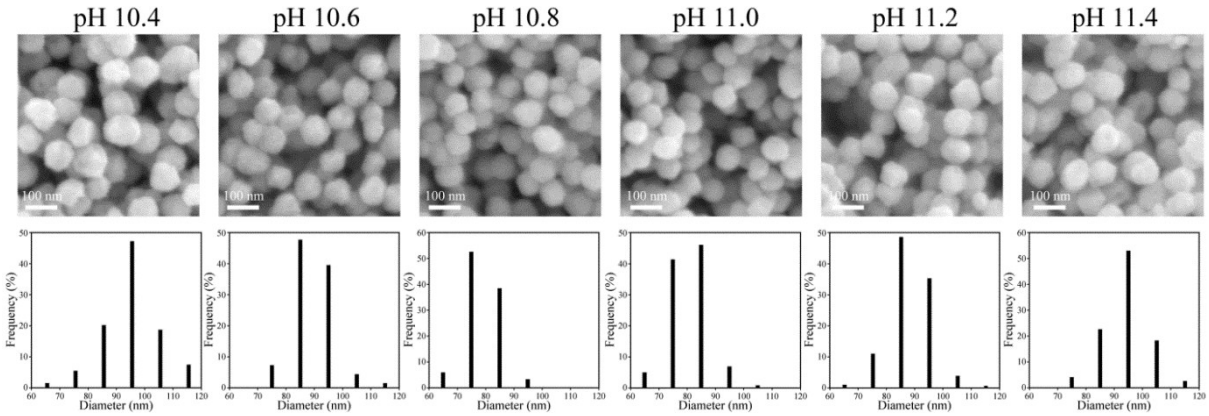

Fig. S2 SEM micrographs and particle size distribution of the Cu NPs synthesized at 70 ^{o}C and various pH values.

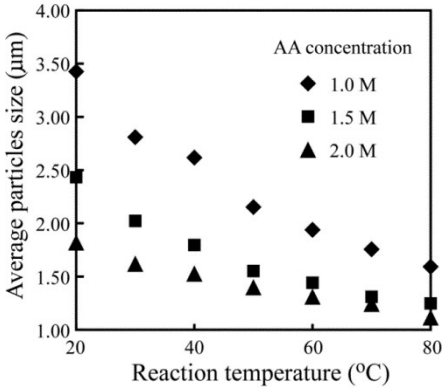

Fig. S3 Average particle sizes of the Cu MPs synthesized at various reaction temperatures and AA concentrations at pH 7.0.

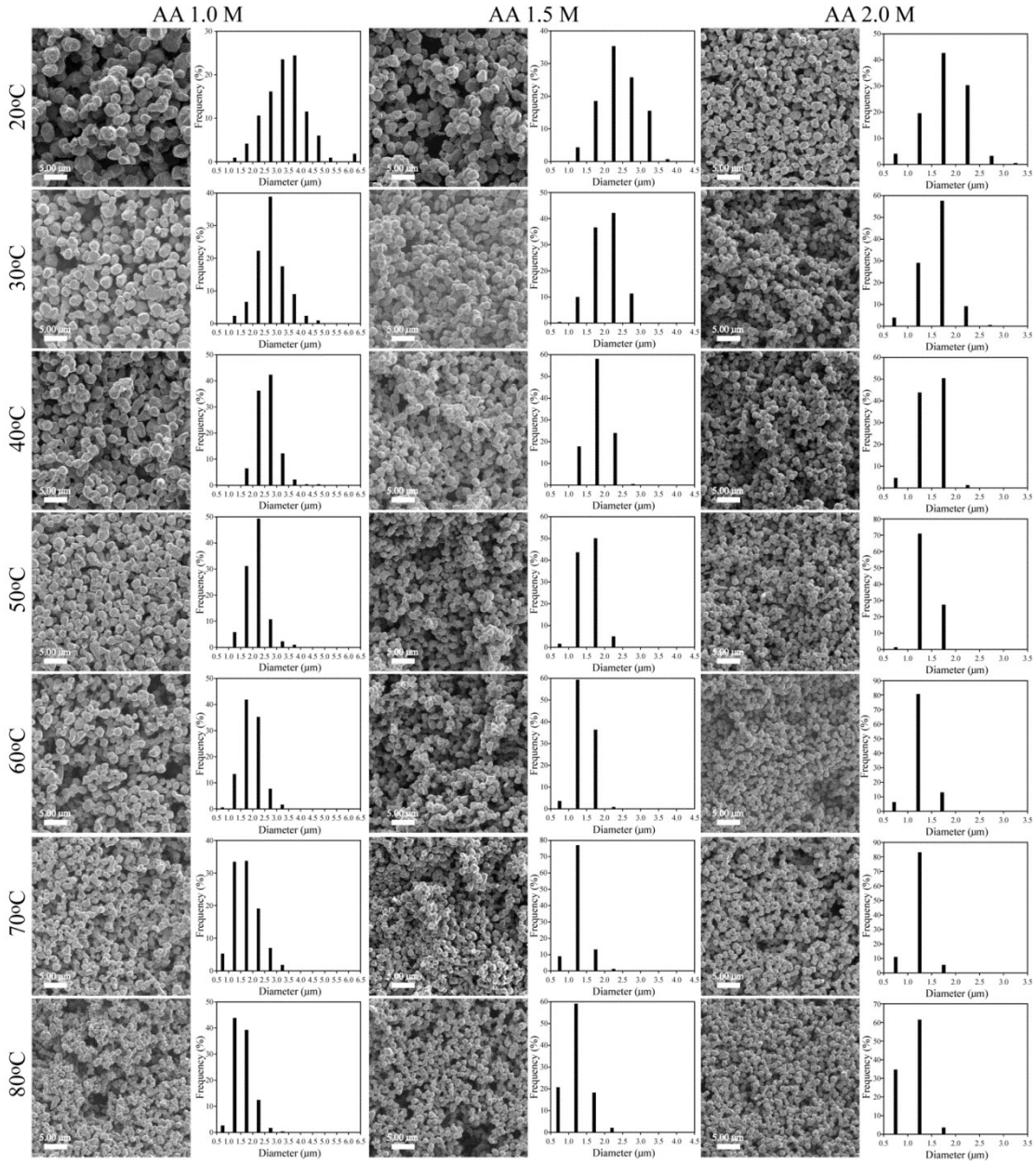

Fig. S4 SEM micrographs and particle size distribution of the Cu MPs synthesized at various reaction temperatures and AA concentrations at pH 7.0.

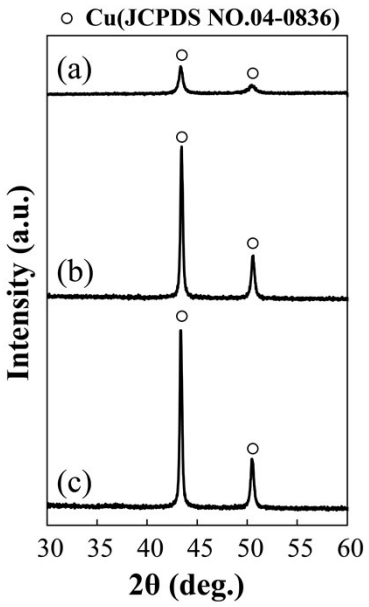

Fig. S5 XRD profiles of (b) the Cu thin film by sintering (a) the Cu NPs synthesized at a CA concentration of 0.12 M (pH = 10.8, reaction temperature = 70°C) (c) The Cu thin film after 1 week under atmospheric condition at 25 ± 2°C.

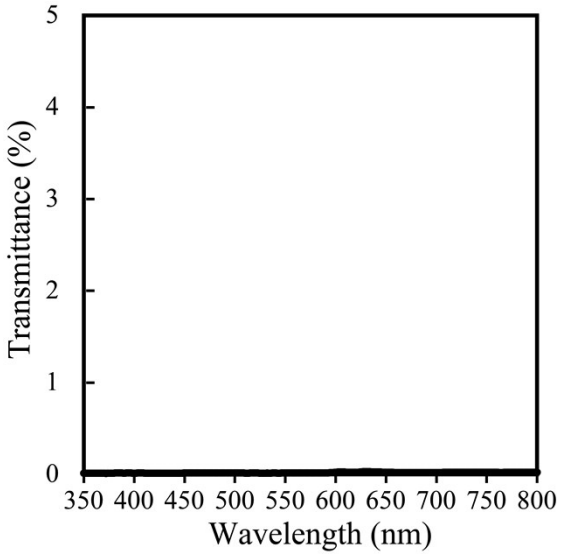

Fig. S6 Visible spectrum of the Cu film by sintering the Cu NPs synthesized at a CA concentration of 0.12 M (pH = 10.8, reaction temperature = 70°C).

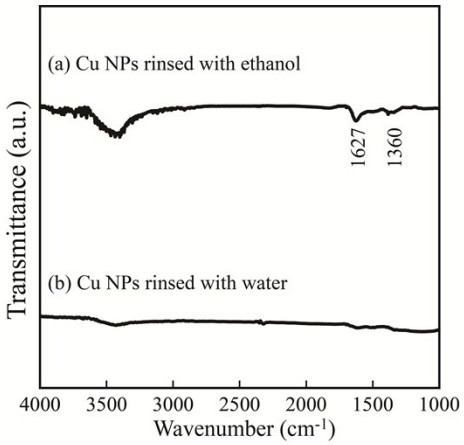

Fig. S7 FT-IR spectra of the Cu NPs synthesized at a CA concentration of 0.60 M (pH = 10.8, reaction temperature = 70°C) after rinsed with (a) ethanol and (c) water.

Table S1. ESI-TOFMS molecular ion data with parameters used to identify the molecular formulae of the filtrate obtained from the Cu NPs washing by using water

Measured m/z	Calculated m/z	err (mDa)	err (ppm)	mSigma	Relative intensity (%)	chemical formula
191.019405	191.019726	0.3	1.7	9.7	100.00	$C_6H_7O_7^-$

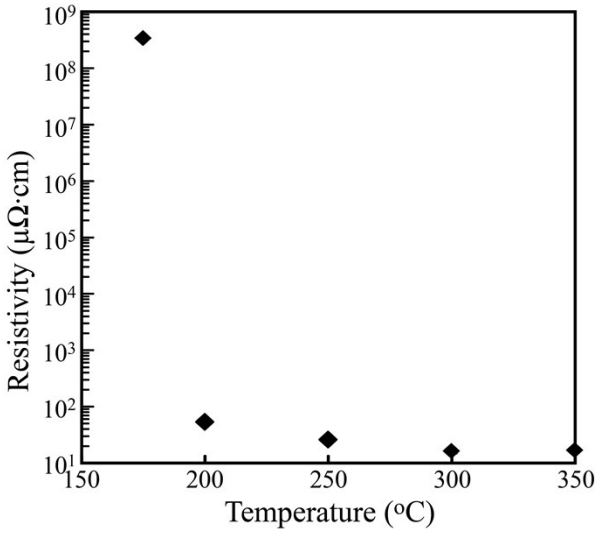

Fig. S8 Resistivity of the Cu films prepared by sintering Cu NPs at different temperatures.

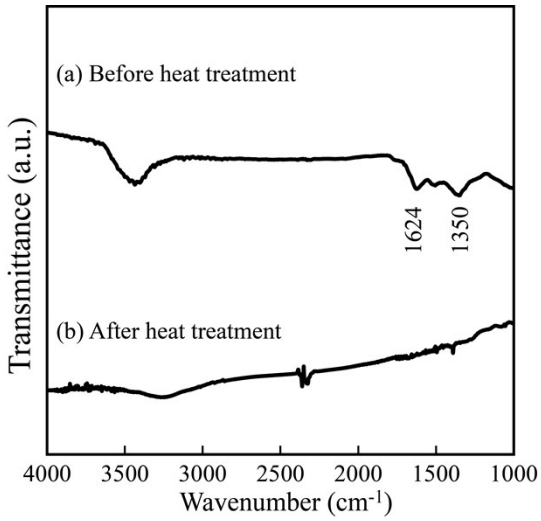

Fig. S9 FT-IR spectra of (b) the Cu thin film prepared by sintering (a) the Cu NPs synthesized at at a CA concentration of 0.12 M (pH = 10.8, reaction temperature = 70°C).

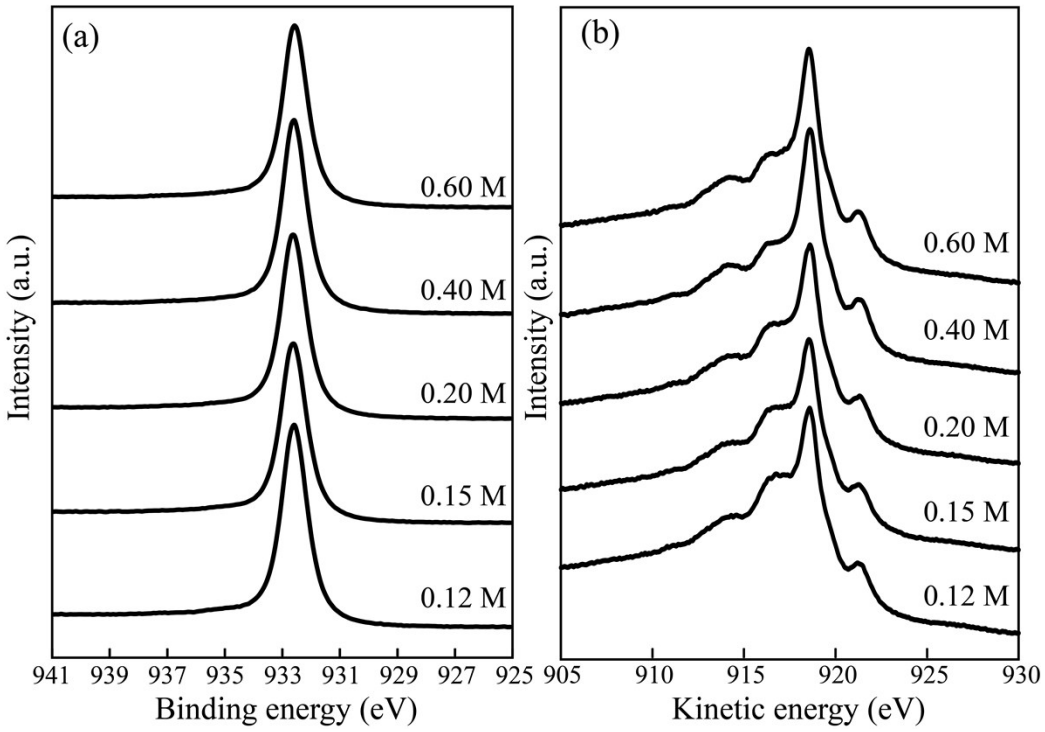

Fig. S10 XPS and Auger profiles of the Cu NPs synthesized between citric acid concentration 0.12 M and 0.60 M at pH 10.8 and 70°C: (a) XPS profiles at the Cu 2p region and (b) Auger profiles at the Cu LMM region.

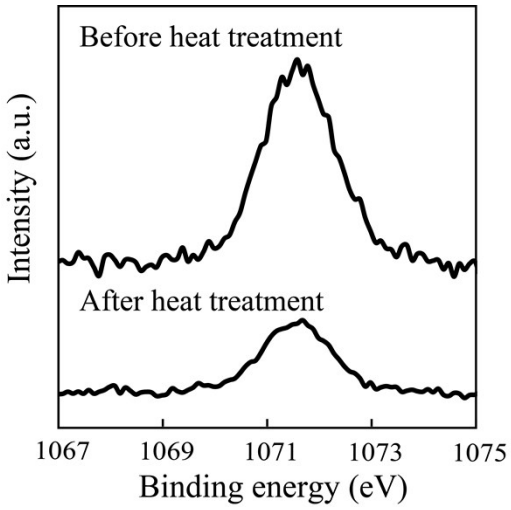

Fig. S11 XPS profiles at the Na 1s region of the Cu NPs synthesized at a CA concentration of 0.12 M (pH = 10.8, reaction temperature = 70^{o}C) after and before heat treatment at 300 ^{o}C.