

Electronic Supplementary Information (ESI). Conducting Ink Dispersing Copper Nanoparticles Synthesized by Hydroxyl Ion - Assisted Alcohol Reduction

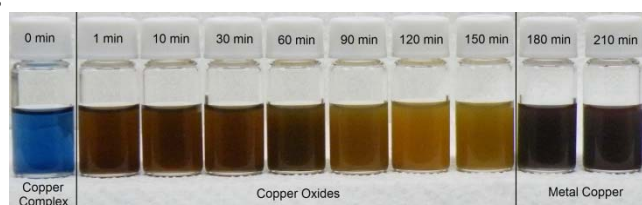


Figure S1. Color changes of copper acetate – oleylamine – 1-heptanol solution after adding OH^- ions. The colors that the solutions take during the reduction of copper acetate could be related with the formation of intermediate products such as CuO , Cu_2O and metal copper.

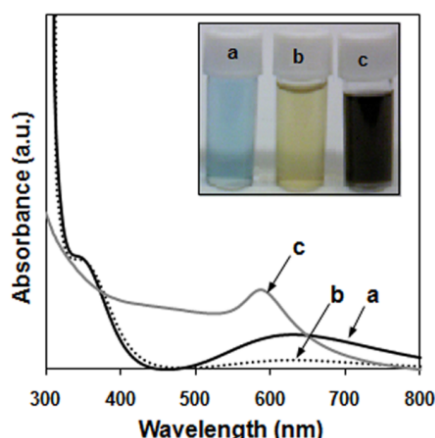


Figure S2. UV-Vis spectra of $\text{Cu}(\text{OAc})_2$ -oleylamine-1-heptanol system at higher OH^- ion concentration. a) before adding OH^- ions, b) 1 min and c) 10 min after adding 23 mM OH^- ions. The reaction was carried out at 140°C . A characteristic absorbance peak of metal copper is obtained after 10 min of reaction. The intermediate compounds CuO and Cu_2O were not detected due to the acceleration of reaction kinetics caused by the addition of higher OH^- ion concentration.

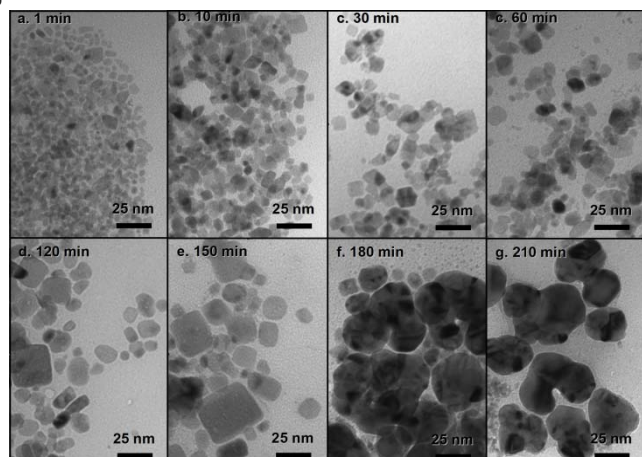


Figure S3. TEM images of the solids formed at different reaction time during the formation of copper nanoparticles in 1-heptanol at 140°C after adding hydroxyl ions. a) First minute of reaction, irregular shaped particles were obtained (CuO). b-e) The particles progressively increased in size and their original shape transformed to cubes (Cu_2O). f-g) At prolonged reaction times, the cube shape particles are transformed to spherical particles (metal Cu).

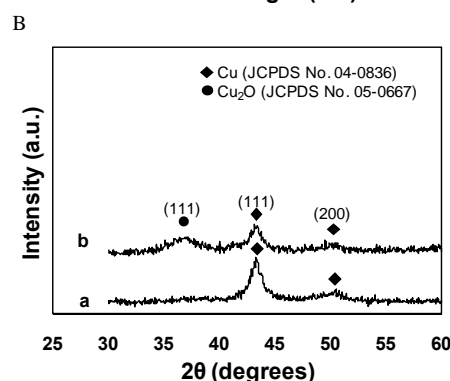
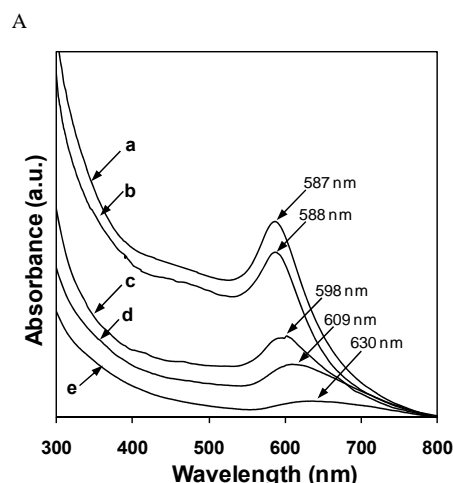


Figure S4. Oxidation of copper nanoparticles. A) UV-Vis spectra of copper nanoparticles dispersed in toluene. a) As-synthesized copper nanoparticles, b) 1 min c) 10 min, (d) 60 min and (e) 24 h after exposing in air. The intensity of absorbance peak of copper nanoparticles progressively decayed and is shifted to higher wavelength due to formation of copper oxide. B) XRD patterns of (a) as-synthesized and (b) particles exposed for 1 week in air. Copper nanoparticles are partially oxidized forming Cu_2O phase.

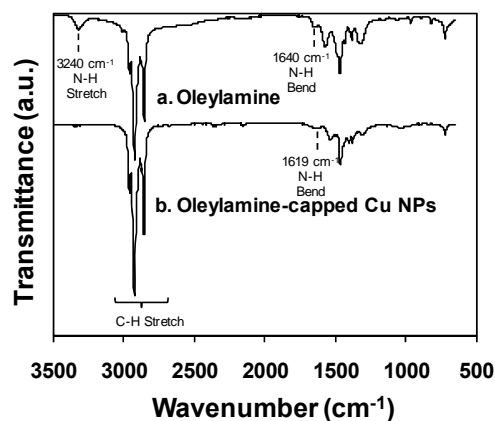


Figure S5. The FT-IR analysis of a) oleylamine and b) oleylamine-capped copper nanoparticles. Sample (a) and (b) shows the $-\text{CH}_2$ symmetric and asymmetric stretching vibrations at 2852 and 2920 cm^{-1} , respectively, revealing the adsorption of the oleyl group on the surface. In addition, a band assigned to N-H stretching mode was observed at 3240 cm^{-1} decreased in intensity and another ascribed to N-H bending mode detected at 1640 cm^{-1} was shifted to 1619 cm^{-1} probably both phenomena due to the interaction between N and Cu through coordination.