Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.
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Supplementary Information

Efficient one-step synthesis of p-type copper oxide for low-temperature, solution-processed thin-film transistors

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Fabrication of Al_2O_3 dielectric films and devices. The Al_2O_3 precursor solution with a concentration of 0.2 M was prepared by dissolving $Al(NO_3)_3 \cdot 9H_2O$ in DI water. The precursor solution was spun on the Si substrate at 5000 rpm for 20 s and annealed at 350 ^oC for 1 h in air. The coating process was repeated twice to achieve an appropriate thickness (30 nm). After that, the CuI precursor solution was spun on the Al_2O_3/p^+-Si substrate. The laminated thin films were then annealed at 250 ^oC for 1 h. Finally, Ni source and drain electrodes were deposited by thermal evaporation using the same shadow mask.

The analysis equipments for Al_2O_3 and Cu_xO thin films and TFTs. The thicknesses of CuI, Cu_2O, and CuO thin films were measured using ellipsometry (ESS01, Sofn Instrument). The crystal structures of Cu_xO thin films were investigated by X-ray diffractometer (XRD, X'Pert-PRO MPD and MRD, PANalytical, Holland) with a Cu$K\alpha1$ radiation. The surface morphologies of Cu_xO thin films were measured by using an atomic force microscope (AFM, SPA-400, Seiko). The chemical compositions of Cu_xO thin films were analyzed by X-ray photoelectron spectroscopy (XPS, ESCALAB 250). The electrical properties of Al_2O_3 capacitor and TFTs were investigated by using a semiconductor parameter analyzer (Keithley 2634B) in a dark box.

The calculation details of device parameters. The on/off current ratio (I_{on}/I_{off}) is defined as the ratio of drain current in the on state (I_{on}) to the drain current in the off state (I_{off}). The threshold voltage (V_{th}) is determined from linear fits to the dependence of the $I_D^{1/2}$ on V_G. The subthreshold swing (SS) value is defined as the V_{DS} required to increase the I_{DS} by one decade.

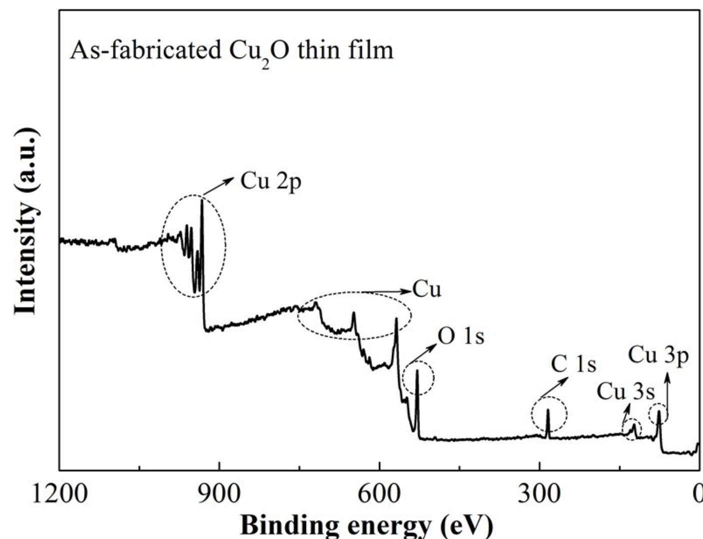

Fig. S1 XPS spectrum of as-prepared Cu_2O thin film.

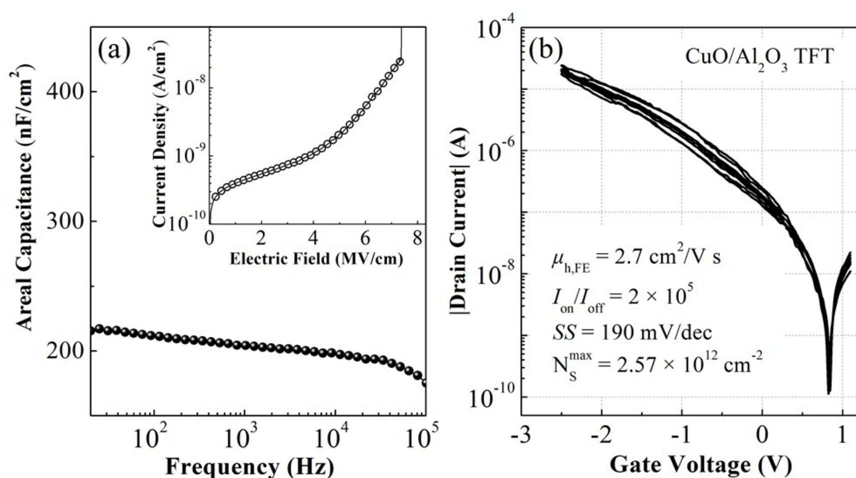

Fig. S2 (a) Areal capacitance of an Al/Al_2O_3/p^+-Si capacitor as a function of frequency. The leakage-current density versus electric field is shown in the inset. (b) Transfer curves of CuO-250/Al_2O_3 TFTs.