# Electronic Supplementary Information

# Rapid design of core-shell-like metal hydroxide/oxide composite and activated carbon from biomass for high-performance hybrid supercapattery application

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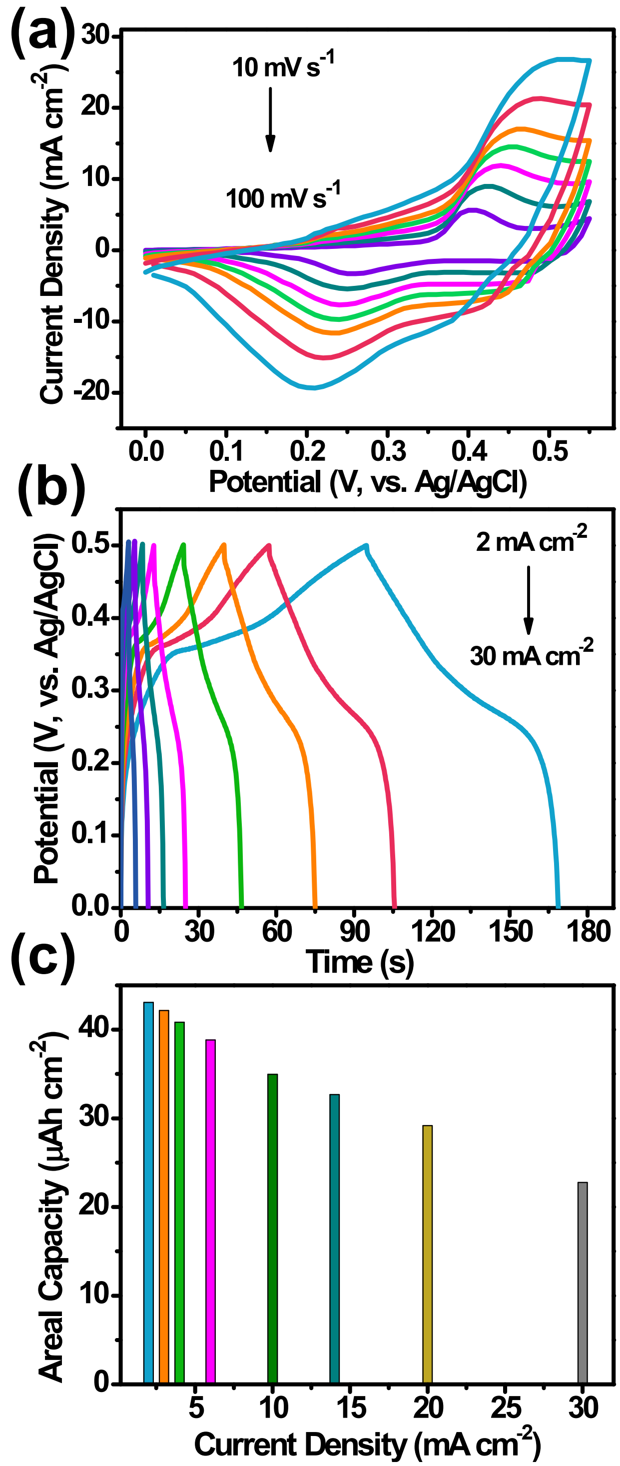


**Fig. S1.** (a-b) CV and GCD curves of the bare $Cu_2O$ CAS electrode investigated at different scan rates and current densities, respectively. (c) Estimated areal capacity values of the bare $Cu_2O$ CAS electrode.

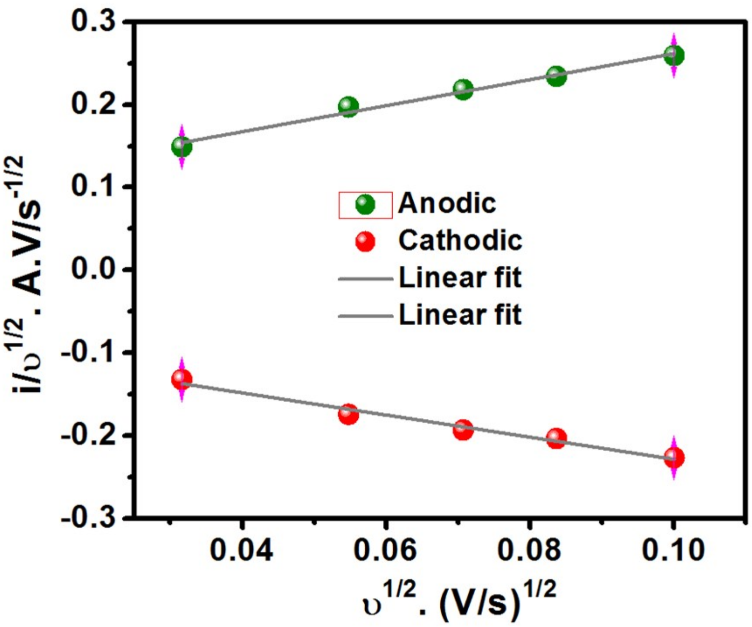


**Fig. S2.** Relationship between applied scan rates and peak currents.

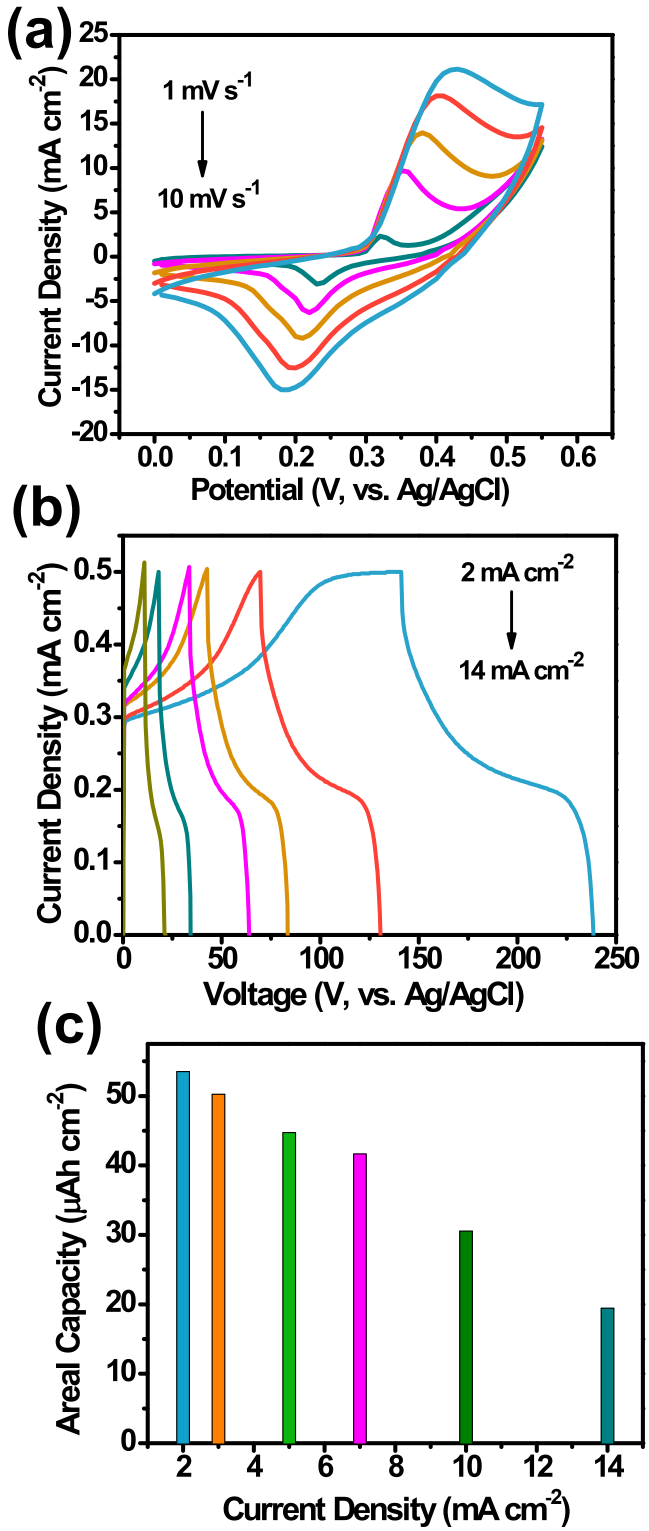


**Fig. S3.** Electrochemical performance of bare $Ni(OH)_2$ electrode. (a) CV curves and (b) GCD curves and (c) areal capacity values *vs.* current densities.

Fig. S3(a) shows the cyclic voltammetry (CV) curves measured at different scan rates from 1 to 10 mV $s^{-1}$ in the potential range of 0-0.55 V. All the CV curves demonstrated two prominent redox peaks, indicating that the charge storage process in $Ni(OH)_2$ material mainly governs the Faradaic redox reactions. Even at high scan rate of 10 mV $s^{-1}$, the CV curve retained its shape without distortion and the redox peaks still can be observed, indicating the good reversibility of material. The galvanic charge-discharge (GCD) tests were also investigated in the fixed potential window of 0-0.55 V at different current densities (2-14 mA $cm^{-2}$) and plotted in Fig. S3(b). In well-agreement with the CV results, the obtained GCD plateaus with non-linear curves further confirmed the Faradaic charge storage mechanism. Based on the discharge time, the areal capacities of $Ni(OH)_2$ material were calculated using Eq. (1). The obtained areal capacity values were 53.5, 50.2, 44.7, 41.6, 30.5 and 19.4 µAh $cm^{-2}$ at the current densities of 2, 3, 4, 6, 10 and 14 mA $cm^{-2}$, respectively and the obtained values were plotted against current densities in Fig. S3(c).

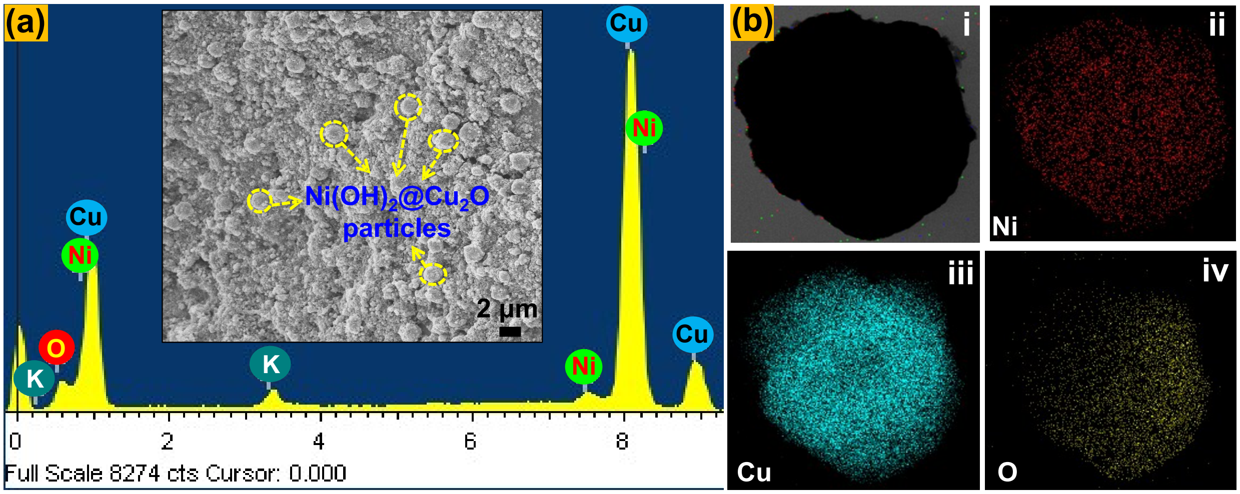


**Fig. S4.** (a) EDX spectrum and (b) elemental mapping images of $Ni(OH)_2@Cu_2O$ particles recorded after long-term stability test. Inset in (a) shows the FE-SEM image of $Ni(OH)_2@Cu_2O$ particles.