Supporting Information

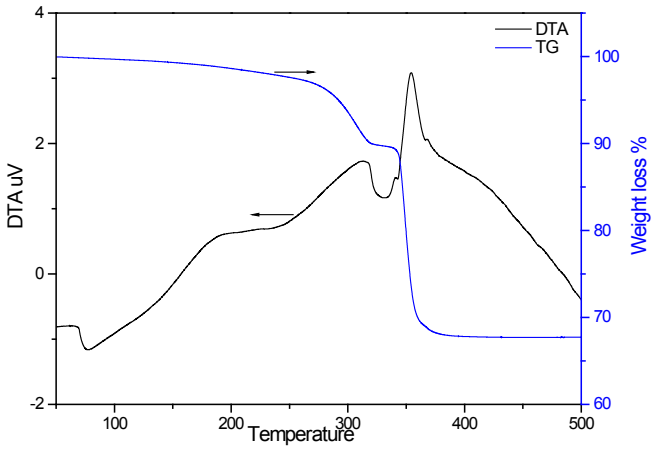


Figure S1. TG-DTA curves of Co_3O_4 precursors carried out under a flowing H_2/Ar (5 vol% H_2) atmosphere with a heating rate of 5℃min^{-1} from ambient temperature to 500 ℃.

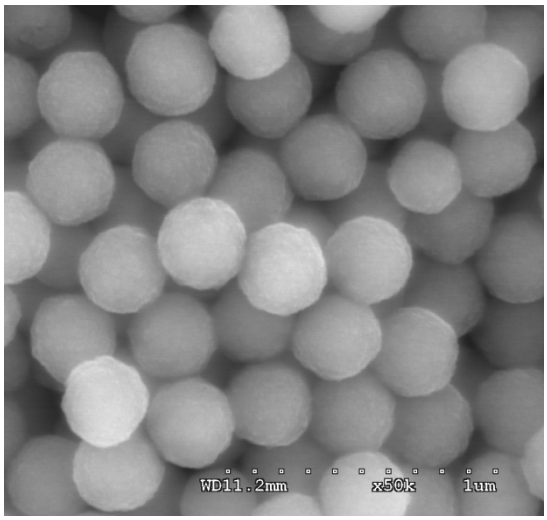
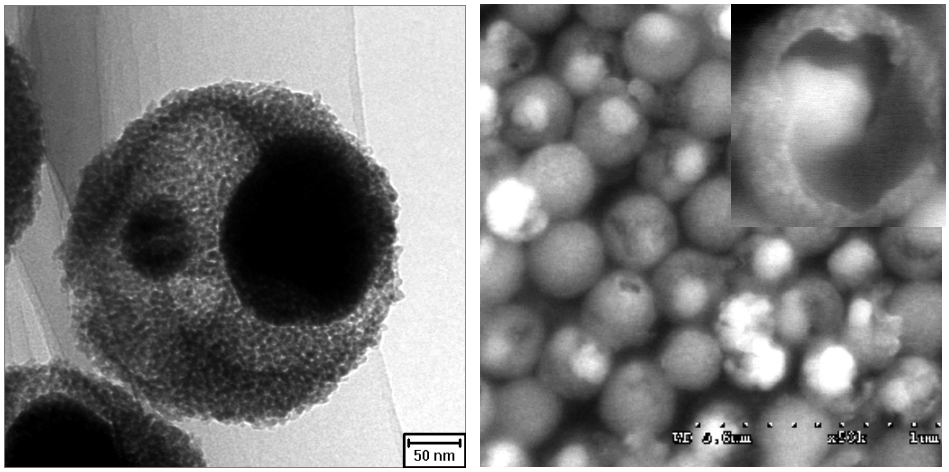


Figure S2. SEM image of Co_3O_4. The products consist of a large quantity of monodispersed spheres. The spherical shape is very homogeneous, and the size of the nanospheres is about 250 nm with a very narrow size distribution.



(a) (b)

Figure S3 (a) TEM image of Co@CoO, and (b) SEM image of Co@CoO. The inset in (b) is a single broken spherical shell and an exposed core.

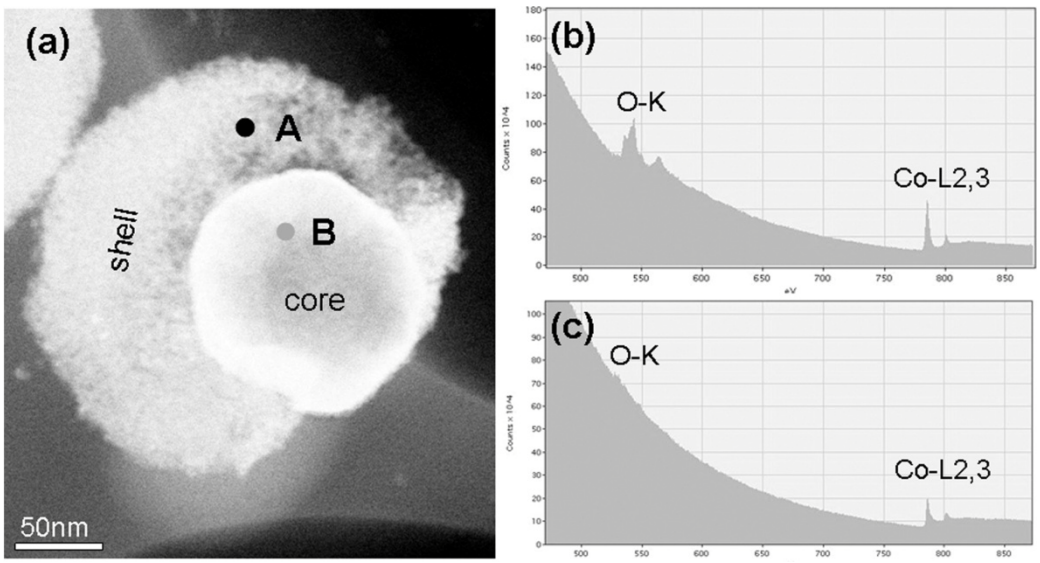


Figure S4. (a) STEM-HADDF image of the core-shell structure. (b) EEL spectrum taken from point A of (a). It can be seen that both oxygen K-edge and cobalt L-edge are clearly revealed in the spectra at 540 and 785 eV, respectively. (c) EEL spectrum taken from point B of (a). The oxygen K-edge has nearly disappeared, which indicates that O is absent from the core. The EELS results confirm that the nanocomposites consist of the metal Co nanoparticles encapsulated in CoO.

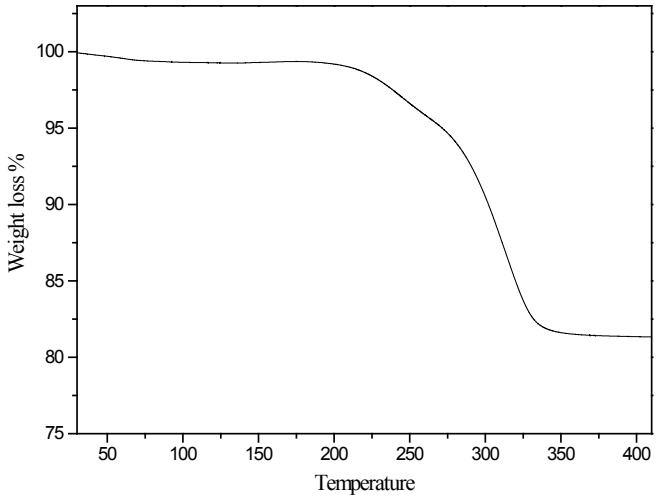


Figure S5. TG curve of Co@CoO carried out under H_2/Ar (5 vol% H_2) with a heating rate of 5°Cmin^{-1}. The calculated content of CoO is 87.5% from the loss of 18.7 wt% oxygen in the TG profiles.

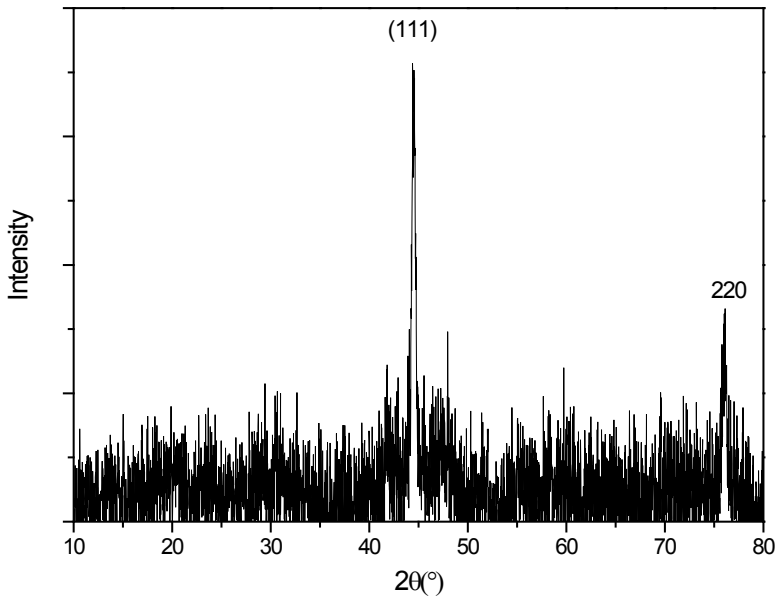
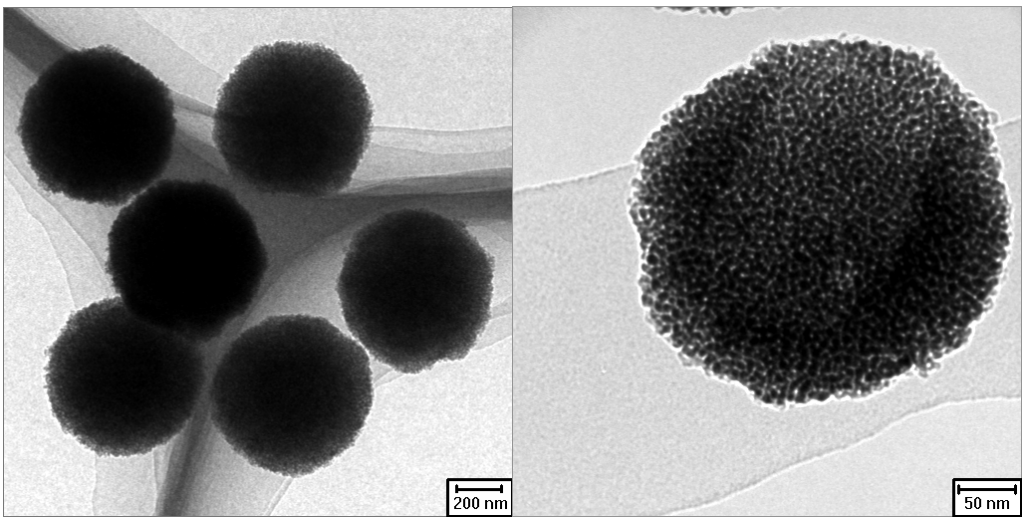
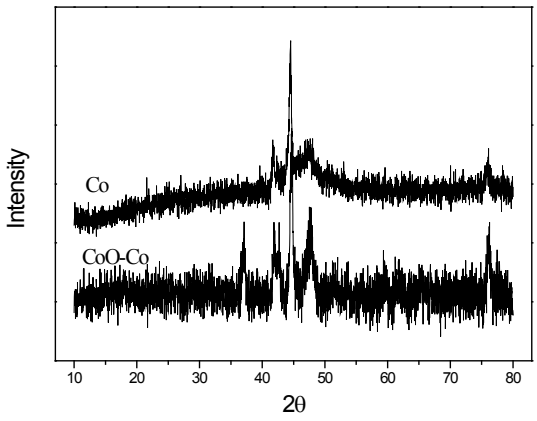


Figure S6. XRD pattern of Co after thermal treatment of 180 min in a flowing Ar/H_2 atmosphere.

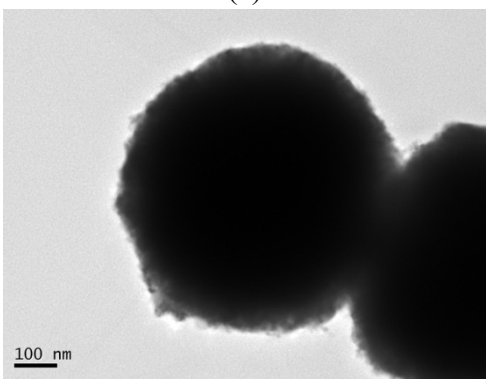


(a) **(b)**

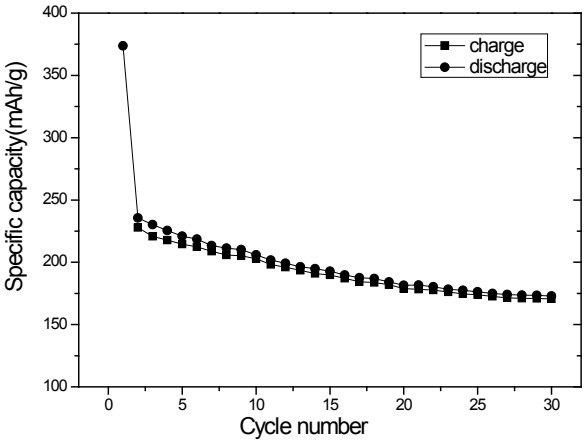
Figure S7. (a) and (b) TEM images of pure CoO. It can be seen that the products have a homogeneous spherical shape and the sizes are similar to the Co@CoO sample.



(a)



(b)



（C）

Figure S8. View of the Co@CoO samples without void between Co core and CoO shell (a) XRD patterns, (b)TEM images , and (c) The capacity retention properties at a current density of 50 mAg^{-1} under 20 ℃.