Electronic Supplementary Material (ESI) for CrystEngComm

Supporting information for

Controlled transformation of ZnO nanobelts into CoO/Co_3O_4 nanowires

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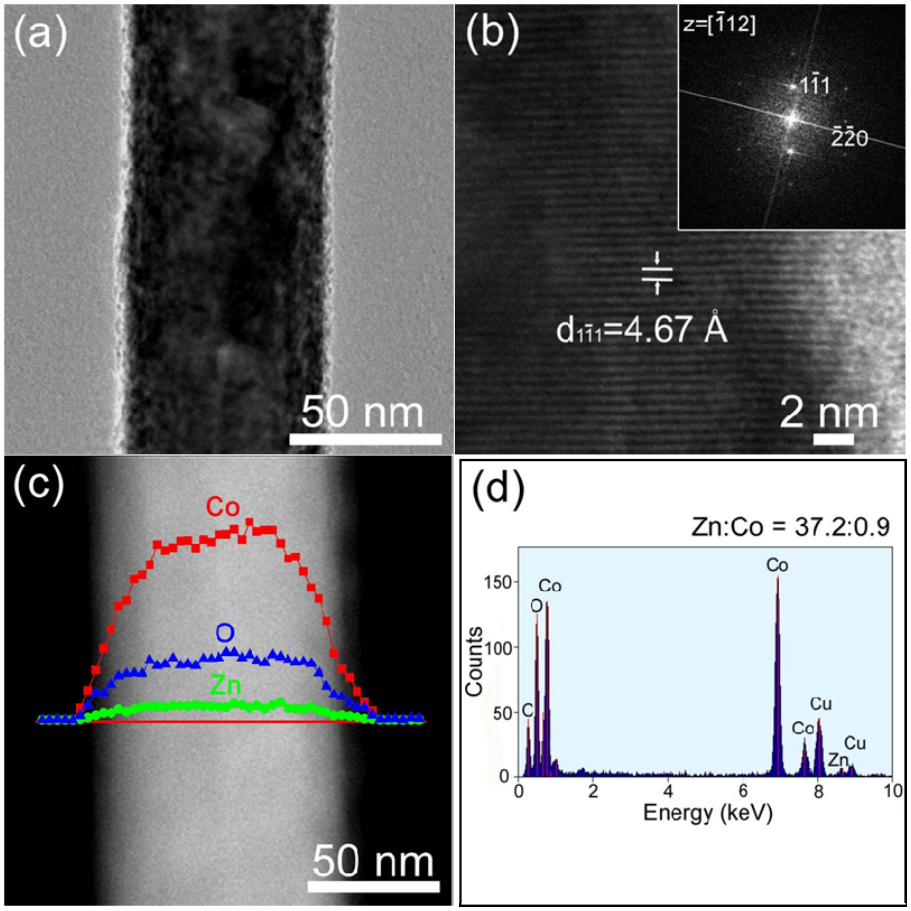

Fig. S1 Morphologies and crystal structures of Zn doped Co_3O_4 NWs: (a) and (b) TEM images of Zn doped Co_3O_4 NWs; (c) EDS line-scanning of Co, Zn and O; (d) EDS spectrum of Zn containing Co_3O_4 NW

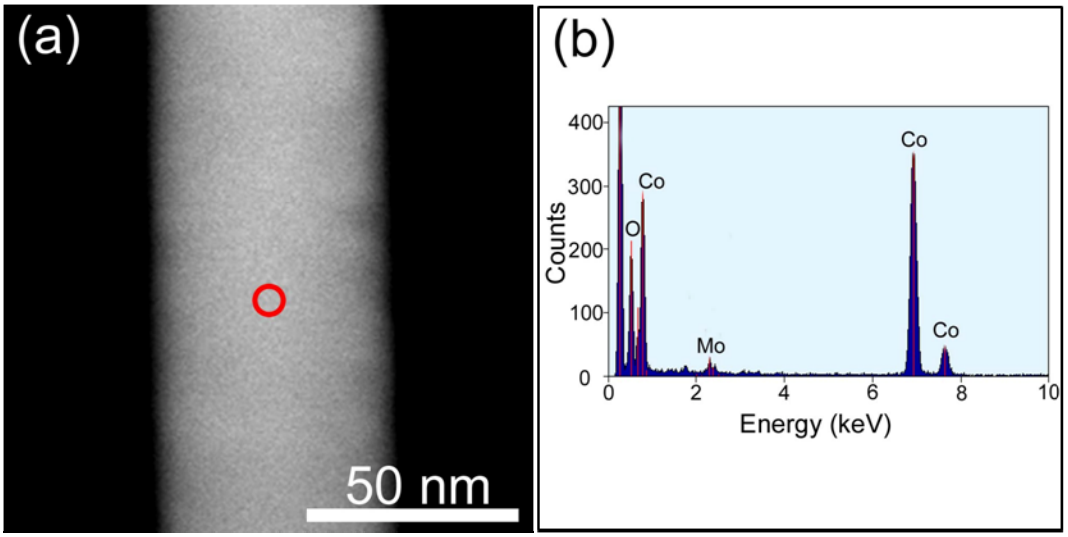

Fig. S2 (a) high-angle annular dark field (HAADF) scanning TEM (STEM) image of Co_3O_4 NW (b) EDS spectrum of Co_3O_4 NW

In order to distinguish between the Co_3O_4 and the $ZnCo_2O_4$, we measured the Raman scattering of the ZnO NBs, ZnO-$ZnCo_2O_4$ core-shell NCs and Co_3O_4 NWs (Fig. S3). ZnO NBs observed two Raman active peaks at 334.8 (A_1) and 442.1 cm^{-1} (E_2).[1] The Co_3O_4 exhibits five Raman active peaks at 190.8 (F_{2g}), 478.6 (E_g), 519.2 (F_{2g}), 616.6 (F_{2g}), and 684.5 cm^{-1} (A_{1g}).[2] For the Co_3O_4 spinel, Raman mode at 684.5 cm^{-1} (A_{1g}) is attributed to characteristics of the octahedral sites and the E_g and F_{2g} modes are likely related to the combined vibrations of tetrahedral site and octahedral oxygen motions in $Zn_yCo_{3-y}O_4$.[3] The E_2 (modes of ZnO-$ZnCo_2O_4$ core-shell NCs which are lower than that of ZnO NBs can be explained by the incorporation of Co into ZnO lattice.[4] Relatively high intensities of E_g and F_{2g} modes compared to that of A_{1g} mode indicate that the $ZnCo_2O_4$ shell layer is formed by the incorporation of Zn components into Co_3O_4.

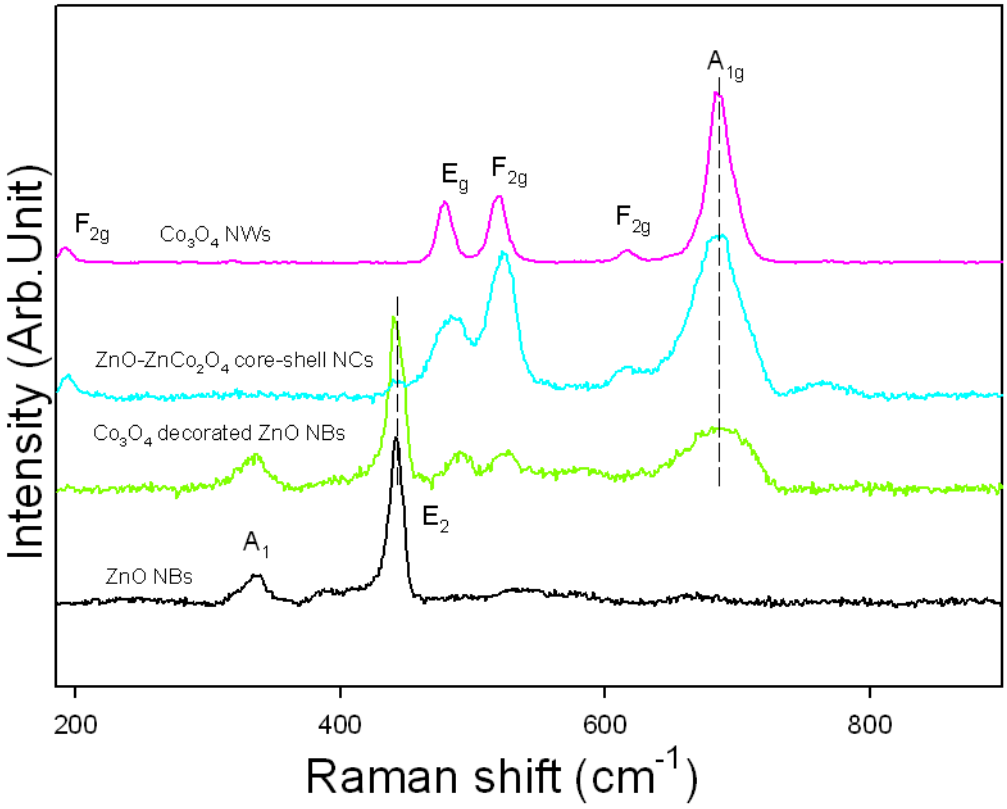

Fig.S3 Raman scattering of ZnO NBs, Co_3O_4 decorated ZnO NBs, ZnO-$ZnCo_2O_4$ core-shell NCs and Co_3O_4 NWs

Table S1. Peak position/fwhm/Area % values of the deconvoluted bands derived from the XPS Zn $2p_{3/2}$ peak, and peak position/fwhm of the XPS Co $2p_{3/2}$ peak, for the ZnO NWs, Co_3O_4-decorated ZnO NWs, ZnO-$ZnCo_2O_4$ core-shell NCs, Co_3O_4 NWs, and CoO NWs

	Zn $2p_{3/2}$				Co $2p_{3/2}$	
	band	position (eV)	fwhm (eV)	area (%)	Position (eV)	fwhm (eV)
ZnO NBs	Zn-O	1021.8	1.8	100		
Co_3O_4-decorated ZnO NBs	Zn-O	1021.8	1.8	80	779.6	~3.3
	Zn-Cn	1022.6	1.7	20		
ZnO-$ZnCo_2O_4$ core-shell NCs	Zn-O	1021.8	1.8	75	779.6	~3.1
	Zn-Co	1022.7	1.5	25		
Co_3O_4 NWs					779.8	~3
CoO NWs					780.5	~4

Reference

1. R. P. Wang, G. Xu, and P. Jin, *Phys. Rev. B*, 2004, **69**, 113303

2. X. Wang, J. Xu, X. Yu, K. Xyu, J. Yu, and X. Zhao, *Appl. Phys. Lett.* 2007, **91**, 031908

3. C. F. Windisch Jr., G. J. Exarhos, R. R. Owings, *J. Appl. Phys.*, 2004, **95**, 5435

4. K. Samanta, P. Bhattacharya, R. S. Katiyar, W. Iwamoto, P. G. Pagliuso, and C. Rettori, *Phys. Rev. B*, 2006, **73**, 245213