Electronic Supplementary Material (ESI) for CrystEngComm
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Supporting Information

Exciton quenching and ferromagnetism-to-ferrimagnetism crossover in diluted magnetic semiconducting $Zn_{1-x}Co_xO$ nanogranular nanofibers

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Figure S1. The setup of electrospinning used in our laboratory. The precision syringe pump (KDS-200, Stoelting, Wood Dale, IL) delivered the polymer precursor solution, and the voltage of electrospinning was maintained by a high-voltage power supply (Glassman High Voltage Inc. model Series FC with a positive polarity). As a high voltage was applied, the precursor solution jet accelerated towards the cathode with a 20-gauge blunt stainless steel needle tip, leading to the formation of the electrospun fiber nonwoven mats onto the Al foil placed over a grounded copper collector plate accompanied by partial solvent evaporation. Upon Co doping, the color of the buffer solution turns from colorless to pink.

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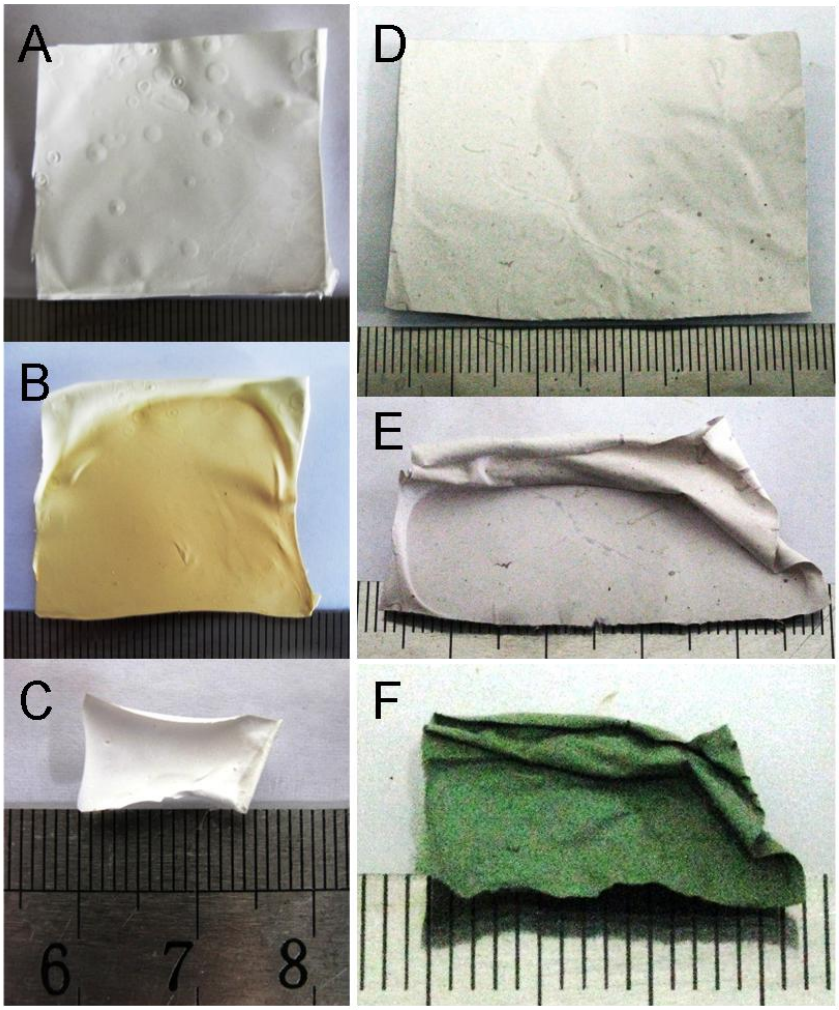

Figure S2. Left, The digital photographs of the as-electrospun pure PVA/ZnO nonwoven fibers mats of (A) as-prepared, (B) sintering at T = 120 °C for one hour, and (C) 550 °C for 5 hours. The color is white, yellow, and white, respectively. Right, The digital photographs of the electrospun Co 4.4 at.% PVA/$Zn_{1-x}Co_xO$ nonwoven fibers mats of (A) as-prepared, (B) sintering at T = 120 °C for one hour, and (C) 550 °C for 5 hours. The color is white, yellow, and green, respectively. Free-standing nonwoven mats of electrospun PVA/$Zn_{1-x}Co_xO$ fibers could also be obtained by peeling off relatively thick films from the aluminum foil. Due to the remarkable mass loss observed (for a detailed description see the text in Fig S4), the as-sintered samples undergo significant volumetric shrinkage during calcination.

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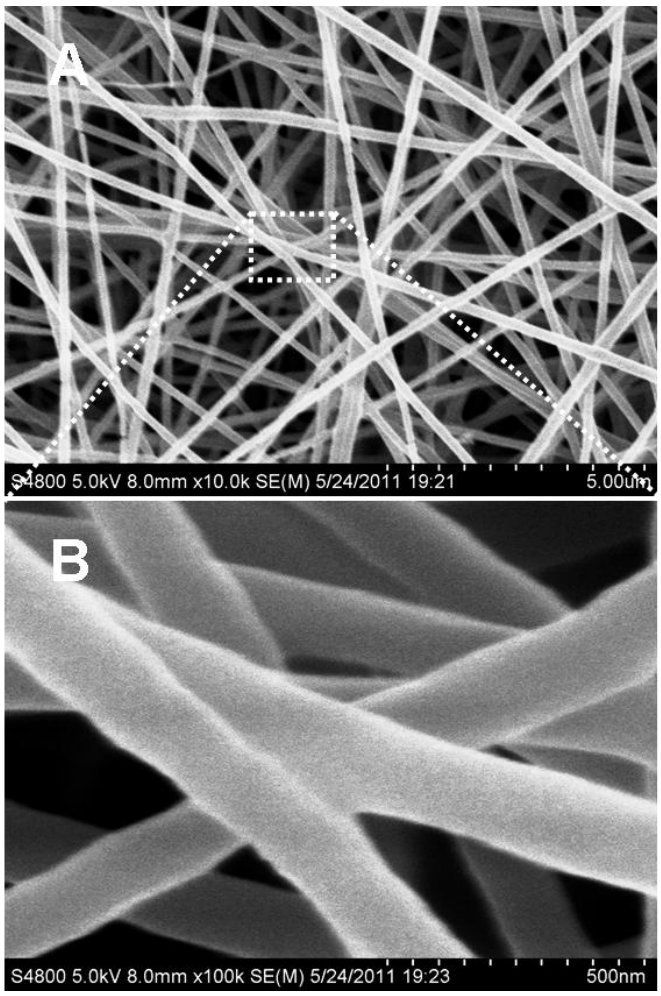

Figure S3. Low- and high-magnification SEM images (A-B) of the as-electrospun PVA fibers, respectively.

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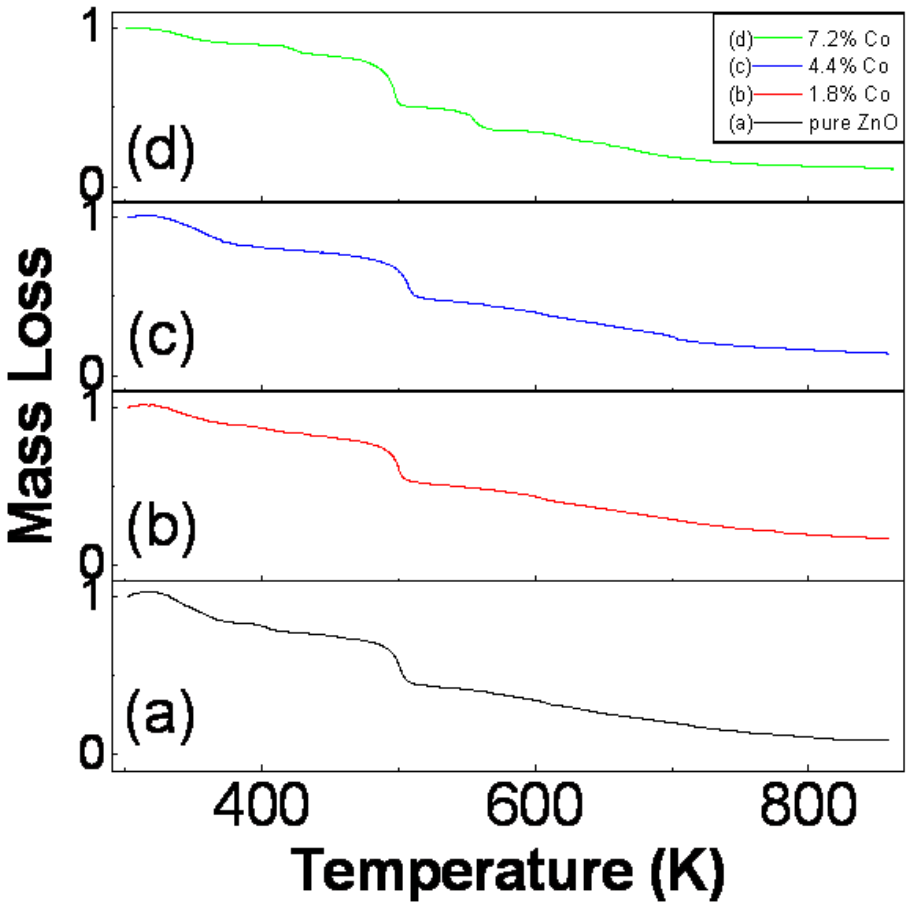

Figure S4. Thermogravimetric analysis (TGA) of the as-electrospun PVA/$Zn_{1-x}Co_xO$ composite fibers with different doping level. The heating rate is at 10 K /min under static atmosphere ambient. The mass loss of the as-electrospun PVA/$Zn_{1-x}Co_xO$ composite fibers is ~ 90.8 wt % (x = 0), ~ 82.8 wt % (x = 1.8 % Co), ~ 86.0 wt % (x = 4.4% Co), and ~ 88.4 wt % (x = 7.2 % Co), respectively.

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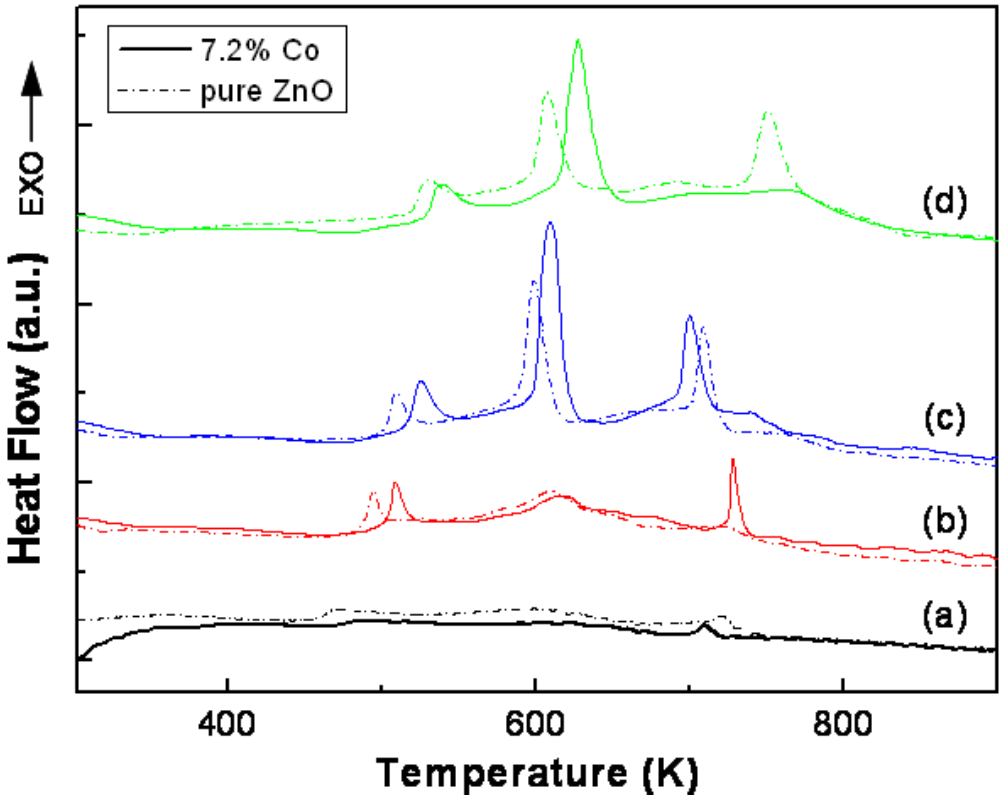

Figure S5. Typical comparison between the continuous DTA traces (well calibrated with tin) of the as-electrospun PVA/$Zn_{1-x}Co_xO$ composite fibers with Co dopant dependence (x = 0, the dashed dot curves, and x = 7.2 % Co, the solid curves) in a static atmosphere at different heating rate of (a) 5 K/min, (b) 10 K/min, (c) 15 K/min, and (d) 20 K/min, respectively.

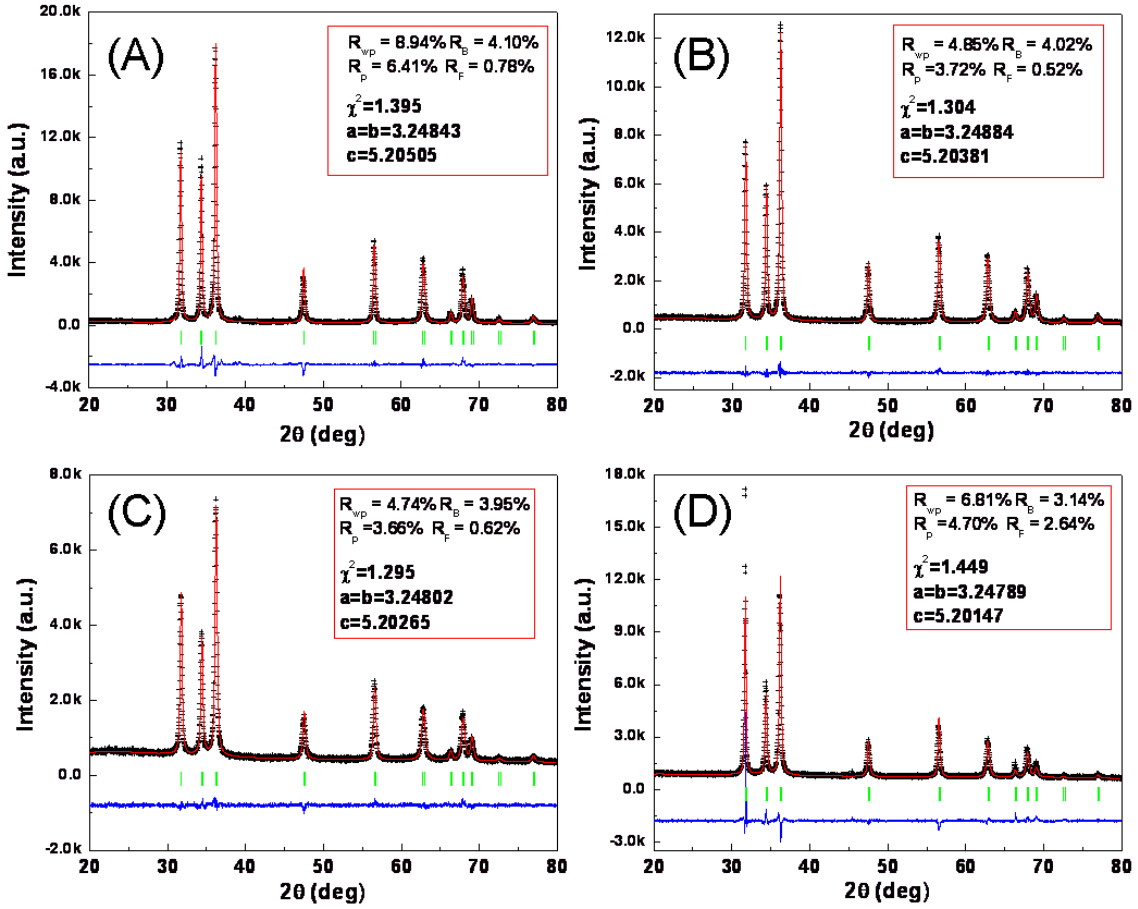

Figure S6. PXRD patterns of the as-calcined electrospun $Zn_{1-x}Co_xO$ nanofibers with different doping level, (A) x = 0, (B) x = 1.8 % Co, (C) x = 4.4% Co, and (D) x = 7.2 % Co, respectively. Insets, lattice parameters (*a*, *c*) at different Co-doping level x.

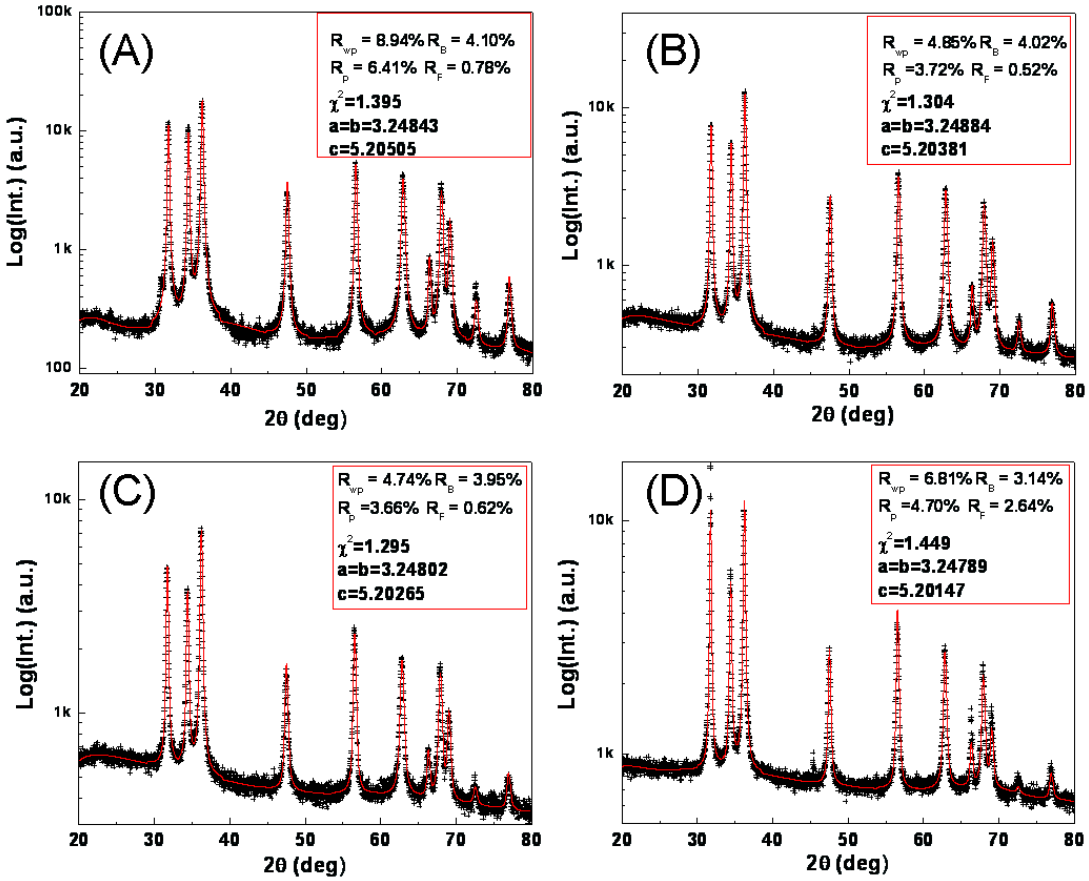

Figure S7. PXRD data on log scale for the y-axis of the as-calcined electrospun $Zn_{1-x}Co_xO$ nanofibers with different doping level, (A) x = 0, (B) x = 1.8 % Co, (C) x = 4.4% Co, and (D) x = 7.2 % Co, respectively. There are no secondary dopant related phases patterns Insets, lattice parameters (*a*, *c*) at different Co-doping level x.

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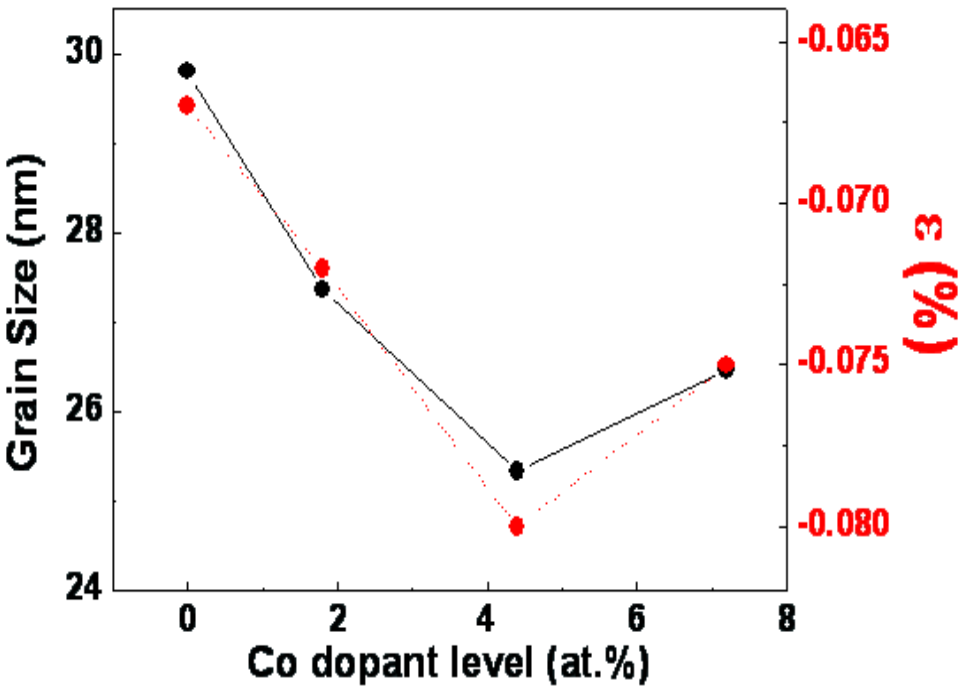

Figure S8. Evolution of the grain size (dark solid circles) and internal strain (red solid circles) of the as-calcined electrospun $Zn_{1-x}Co_xO$ nanofibers as functions of Co-doping level x.

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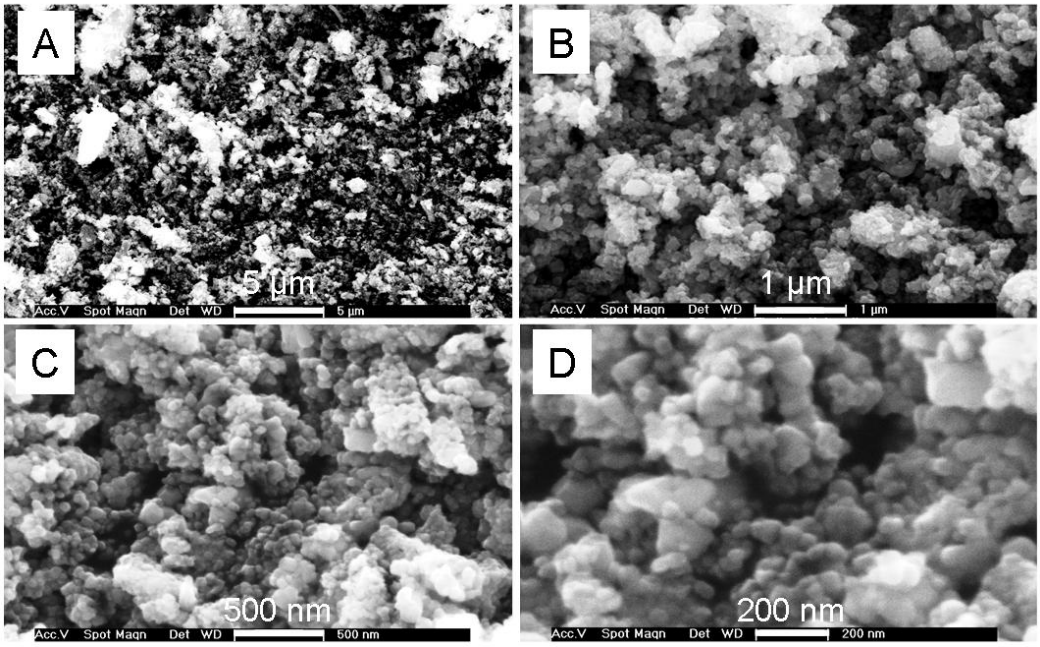

Figure S9. (A-D) Low- and high- magnification SEM images of the as-calcined electrospun $Zn_{1-x}Co_xO$ (x = 4.4 at. %) nanofibers after mechanically fragmented.