Supporting Information

Novel Regrowth Mechanism of CdS Nanowire in Hydrothermal Synthesis

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Figure S1 shows a series of SEM images of the products at various reaction time points. Many short nanowires and nanorods were observed in the products before 10 h. The main product were nanorods between 2.5~4 h. When the reaction time was 8 h, the length of these nanorods is larger than that of nanorods prepared at the time points of 4 h and 6 h. At the reaction time point of 10 h, the products are pure nanowires. Longer reaction time after 12 h, for example 24 h and 96 h, the nanowires grow longer and a little thicker but were not observed broken any more.

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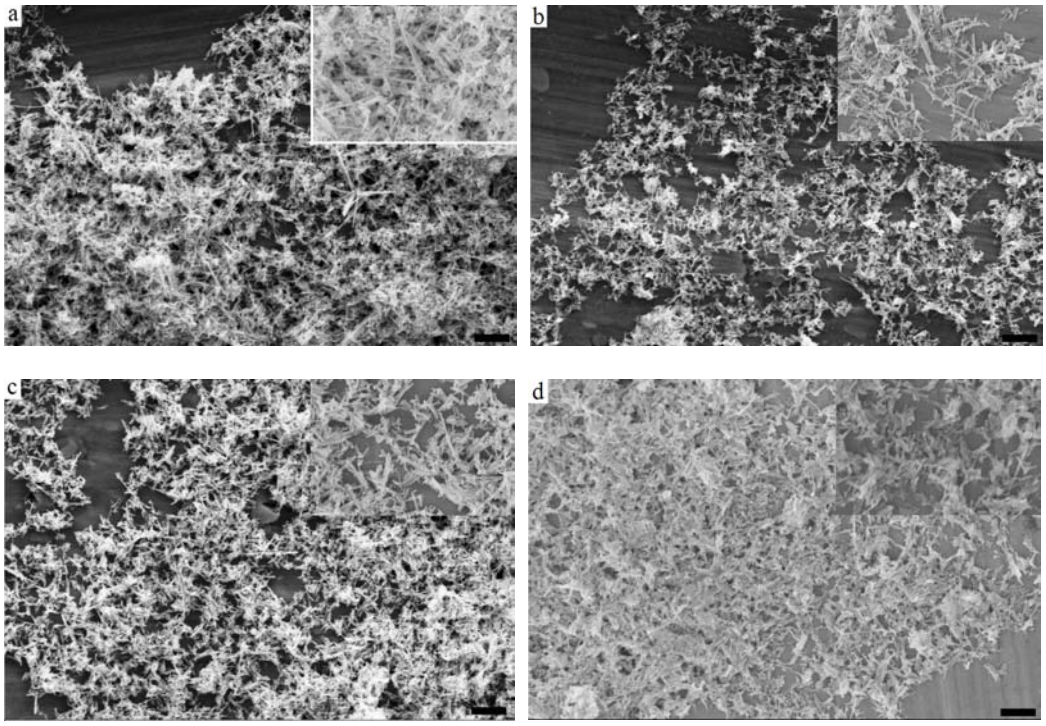

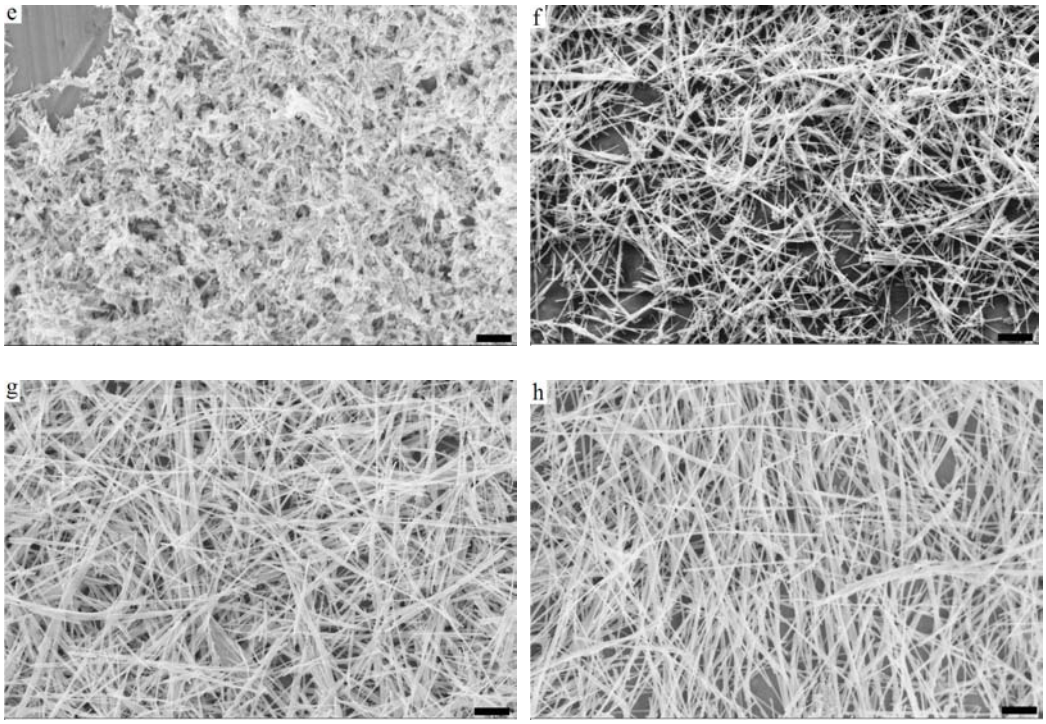

Figure S1 SEM images of CdS nanowires synthesized at reaction time points of (a) 2.5 h, (b) 3 h, (c) 3.5 h, (d) 4 h, (e) 8 h, (f) 10 h, (g) 24 h and (h) 96 h, respectively. All scale bars are 1 μm.

Figure S2 shows that when Cd source was replaced with $Cd(NO_3)_2 \cdot 4H_2O$, CdS nanowires were also observed to form within 3.5 h, break thereafter, and finally re-grow again from short nanorods, indicating such this synthesis system has the same regrowth mechnism of CdS nanowires.

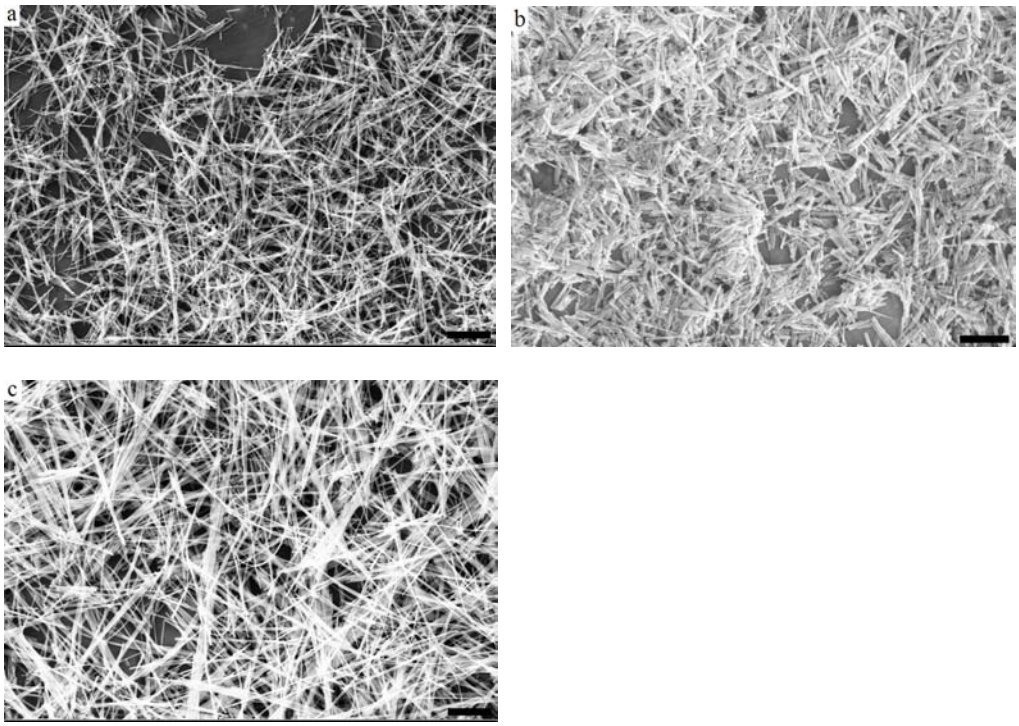

Figure S2 Typical SEM images of products synthesized with optimal conditions for CdS nanowires for (a) 3.5 h, (b) 4 h, and (d) 6 h using $Cd(NO_3)_2 \cdot 4H_2O$ as Cd source, respectively. All scale bars are 1 μm.

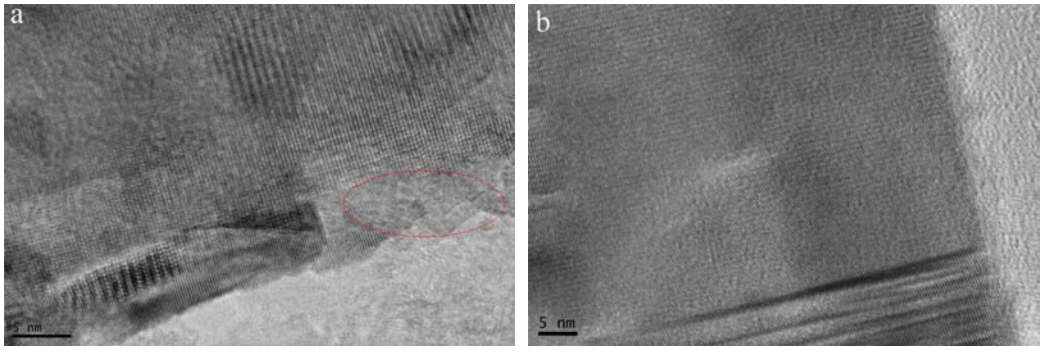

Figure S3 HRTEM images of the CdS nanowires synthesized for (a) 2 h, and (b) 12 h (Ellipse refer to the defect).

Figure S3 shows the structures of CdS nanowires at edges with high resolution. We can find that the surface of the CdS nanowire synthesized for 2 h has more defects (Figure S3a) than that synthesized for 12 h (Figure S3b). We speculated that these defects might be the reason why the CdS nanowire with such structures is liable to be etched and broken.

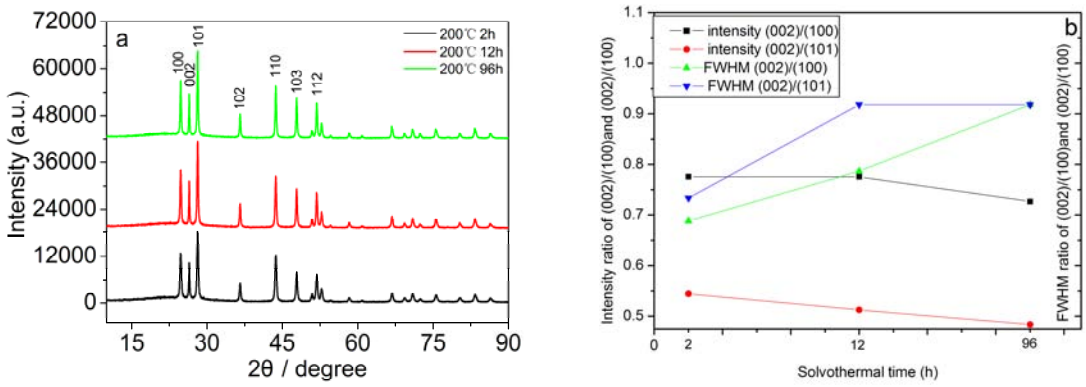

Figure S4 (a) XRD diffraction patterns of CdS nanowires synthesized with S:Cd ratio of 2:1 mol at 200℃ for 2 h, 12 h and 96 h, respectively. (b) The corresponding intensity and fwhm (Full-Width Half-Maximum) ratios of (002) to (100) and (002) to (101) peaks extracted from XRD patterns.

Figure S4 shows the typical XRD patterns of the nanowire products obtained at 2, 12 and 96 h for the fixed reaction temperature of 200℃. All the diffraction peaks can

be readily indexed as wurtzite CdS with lattice constants (a=4.149Å, c=6.731Å) in good agreement with the literature values (JCPDS Card No. 41-1049). No peaks of impurities were detected, indicating the high purity of the products. The three samples have strong and narrow XRD peaks, indicating that the all nanowires synthesized on the three reaction time points are well crystallized (Figure S3a). The intensity ratio and fwhm (Full-Width Half-Maximum) ratio of (002)/(100) and (002)/(101) peaks for the nanowires at 2 h time point are higher and lower than that at 12 h or longer time points, respectively, shown in Figure S3b, demonstrating that the crystallogram of nanowires at 2 h time point is not good as the products gained at 12 h and longer time points.