Synthesis and Characterization of Ultrathin Nanorods, Nanowires, and Nanoribbons of Oxides and Chalcogenides

Taeghwan Hyeon*, Kwangjin An, Sang-Hyun Choi, Jin Joo, Taekyung Yu, and Jung Ho Yu

National Creative Research Initiative Center for Oxide Nanocrystalline Materials and School of Chemical and Biological Engineering, Seoul National University

* E-mail : thyeon@plaza.snu.ac.kr

Uniform-sized ultra-thin nanorods and nanowires of lanthanide oxides were synthesized via non-hydrolytic sol-gel reactions. Ceria (CeO_2) nanowires with a uniform diameter of 1.2 nm and a length of 115 nm were synthesized from the reaction of cerium (III) nitrateand phenyl ether at 320℃ in the presence of oleylamine and oleic acid [1]. The length of the nanowires was varied by changing the concentration of oleic acid. Under an optimized synthetic condition, we were able to synthesize novel tadpole-shaped nanowires consisted of spherical head with a diameter of 3.5 nm and wire-shaped tail with a diameter of 1.2 nm and length of 27 nm. Uniform samaria (Sm_2O_3) nanowires and nanoplates with a thickness of as thin as 1.1 nm were synthesized. We were able to synthesize rectangular shaped samaria nanowires with uniform cross-section dimensions of 1.1 nm 2.2 nm, which corresponded to the size of two unit cells of samaria. Under optimized conditions, we were able to synthesize as much as 10 grams of the nanowires [2].

Uniform sized pencil-shaped CoO nanorods with an extraordinary wurtzite ZnO crystal structure by the thermal decomposition of a cobalt-oleate complex. The dimensions of the CoO nanorods were easily controlled by changing the synthetic parameters. Due to their size uniformity, the nanorods self-assembled to form both horizontal parallel arrangements and perpendicular hexagonal honeycomb superlattice structures. The reduction of the CoO nanorods produced either hcp Co nanorods or Co_2C nanorods [3].

We reported low temperature solution-phase synthesis of one-dimension (1-D) quantum confined CdSe nanoribbons with uniform and ultrathin thickness of 1.4 nm [4]. Very interestingly, the room temperature photoluminescence spectrum of the CdSe nanoribbons showed a sharp peak at 2.74 eV (451 nm) with an unprecedented narrow band of a full width at half-maximum (FWHM) of as small as 70 meV (11 nm), which approaches the limit of homogeneous line broadening of a single quantum dot at room temperature.

References

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[2] *J. Am. Chem. Soc* **2006**, 128, 1786

[3] *J. Am. Chem. Soc* **2006**, 128, in press.

[4] *J. Am. Chem. Soc* **2006**, 128, 5632.