

Lead hydroxide nanowires prepared by solution reaction

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In this paper, we report the synthesis of lead hydroxide nanorods by solution-phase reaction of Pb(II) ions and hydroxide ions.

The typical precipitation procedure to obtain lead oxide nanorods is as follows. A 50ml of 0.01M lead nitrate aqueous solution precursor (0.166g of lead nitrate hydrate with a purity 99.5% dissolved in 50ml distilled water in a 50ml glass beaker) was heated to about 80°C. For synthesizing lead hydroxide nanowires, sodium chloride was added into lead nitrate aqueous solution precursor. When about 0.084g of KOH pellets was added at the same time with vigorously magnetic stirring, white (but not pure white) flocculent precipitate separated out in less than a minute. The precipitate was washed many times (more than 8 times) with distilled water, filtered and dried naturally for overnight. The concentration ratio of Pb²⁺ : Cl⁻ : OH⁻ is 1:6:3.

We have characterized the precipitate by employing scanning electron microscopy, transmission electron microscopy, high-resolution transmission electron microscopy, energy dispersive X-ray spectroscopy and XRD.

Our results indicate that, by adding chloride ions into lead nitrates aqueous solution, the lead hydroxide nanowires can be obtained when an alkali is put into the precursor solution. The chloride ions are the key factor for the formation of nanowire. The length of the nanowires is about several tens of micrometers and the diameters of the nanowires are about several tens of nanometers. The crystal structure of the nanowires was identified by XRD analysis. According to our XRD results, the nanowire is lead hydroxide with crystal structure of hexagonal with $a=5.28\text{\AA}$, $c=12.84\text{\AA}$, and $c/a=2.43$. The SAED pattern consisted of diffraction spots indicates that the lead hydroxide nanowires are single crystals. The HRTEM image also clearly shows the crystal lattice stripe.

Through detailed structure characterization, we confirm that the white precipitates are lead hydroxide nanowires, which are single crystals with hexagonally crystalline structure.

Our controlled experiments affirm that the key factor for the formation of lead hydroxide nanowires is the existence of chloride ions in the precursor lead nitrate aqueous solution.

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