Supporting Information

$Eu_{0.56}Ta_2O_7$: A New Nanosheet Phosphor with the High Intrananosheet-Site Photoactivator Concentration

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Experimental Procedures

Materials. The first precursor $Li_2Eu_{0.56}Ta_2O_7$ was prepared by the solid state reaction of 2:0.667:2 Li_2CO_3:Eu_2O_3:Ta_2O_5 with a 10% excess of Li_2CO_3, which compensate for its loss by evaporation during the heating reaction. This ratio of starting materials was used because the reaction was originally intended to synthesize $Li_2Eu_{2/3}Ta_2O_7$ which is the exact Eu analog of $Li_2La_{2/3}Ta_2O_7$ without any extra vacancies in the Ln site.[1] In addition, this ratio of the staring materials yielded the least amount of impurity phases. These materials are mixed thoroughly in an agate mortar, placed in a capped Pt crucible which is enclosed in a capped alumina crucible, heated up to 1600 ºC at 30 ºC/min, dwelled for 1 min, and furnace-cooled to room temperature.

Second, $Li_2Eu_{0.56}Ta_2O_7$ was protonated by a method similar to that for $H_2La_{2/3}Ta_2O_7$ and $H_2SrTa_2O_7$ with some modifications.[1-5] 1.9 g of $Li_2Eu_{0.56}Ta_2O_7$ was ground and reacted with 190 mL of 2 M HNO_3 for 3 days at room temperature under vigorous shaking in order to exchange Li^+ of with H^+.

Finally, 1.5 g of this protonated precursor was reacted with 375 mL of an approximately 3-fold excess TBAOH aqueous solution. After 1 week of vigorous shaking, a translucent white colloidal nanosheet suspension was obtained. This nanosheet suspension was centrifuged at 2500 rpm for 5 min in order to separate the unexfoliated residue from the nanosheet suspension for the characterizations.

Characterizations. The elemental compositions of the bulk precursors were analyzed by EPMA on JEOL JXA-8500F using the acceleration voltage of 15 kV. The powder XRD (X-ray diffraction) patterns of the bulk precursors were obtained using Cu *K*α radiation on a Rigaku RINT2200V/PC diffractometer. The diffraction peaks were indexed, and the lattice parameters were refined using APPLEMAN software.[6] The structural data of the previously reported $Li_2La_{2/3}Ta_2O_7$ was used as starting parameters for these processes.[1] TEM and SAED were performed on a JEOL JEM-1010 transmission electron microscope at an acceleration voltage of 100 kV. The specimen for this characterization was prepared by dropping and drying diluted nanosheet suspension on a carbon microgrid. The in-plane XRD pattern of $Eu_{0.56}Ta_2O_7$ nanosheets, deposited on a Si substrate by the Langmuir-Blodgett (LB) method,[7] was obtained using the synchrotron radiation (λ = 0.11973(9) nm) of Photon Factory BL-3A at High Energy Accelerator Research Organization (KEK). The morphology analysis was performed by AFM using a Seiko Instruments SPA-400 AFM system with a Si tip cantilever (20 N m^{-1}) in the DFM mode. Finally, photoluminescence excitation and emission properties of $Eu_{0.56}Ta_2O_7$ nanosheets were characterized on a HITACHI F-4500 fluorescence

spectrometer at room temperature. The excitation spectrum was corrected for the spectral distribution of the lamp intensity by the Rhodamine B method, and the emission spectrum was corrected for the spectral response of the instrument using a substandard light source.

References and Notes

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