Intrinsic luminescence of $LaPO_4$ nanoparticles

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Introduction

$LaPO_4$ nanoparticles doped by the different rare earth ions are widely studied not only as model objects for investigation of size effect influence on luminescence properties but also for practical use. However, the luminescent properties of pure $LaPO_4$ nanoparticles are not studied so well. In this work we present the luminescent studies of pure $LaPO_4$ nanoparticles with different sizes from 8 to 50 nm.

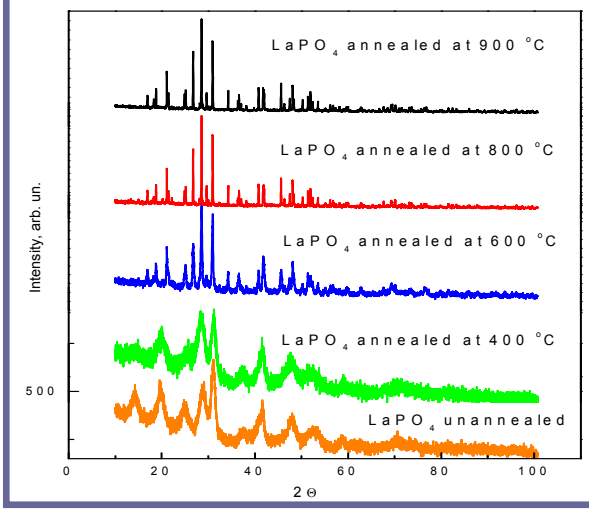

Fig. 2 The X-ray structure analyses of $LaPO_4$ nanoparticles with different sizes at 8 K.

Results

Emission spectrum of the $LaPO_4$ nanoparticles annealed at 800°C with size of 50 nm possess the main emission band in the range of 265 nm. This band is assigned to emission of self-trapped exciton (STE) [1]. The same structure of emission spectra observed also for $LaPO_4$ nanoparticles with grain size of 35 and 40 nm. As it was obtained from X-ray diffraction measurements the $LaPO_4$ nanoparticles of 35-50 nm size possess the monoclinic symmetry of crystal lattice. The nanoparticles of smaller sizes (8-16 nm) possess the hexagonal symmetry of crystal lattice. The structure of emission spectra for nanoparticles with size of 8-16 nm noticeable differs from that for nanoparticles with grain size of 35-50 nm. For these particles there are two luminescence bands peaked at 260 and 335 nm that one can assign to emission of STE. Besides STE emission the broad emission band in the range of 425 nm appears for $LaPO_4$ nanoparticles of 8-16 nm grain size. The nature of this emission is not clear. Because this luminescence band appears in nanoparticles of very small size, one can assume that the emission is caused by surface defects.

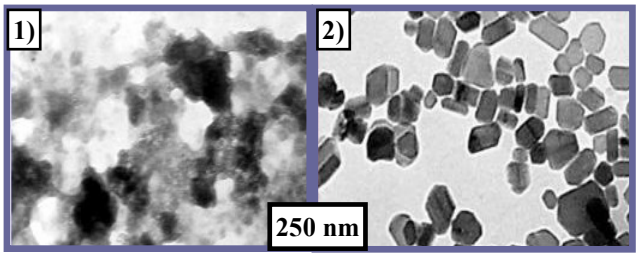

Fig.1 TEM pictures of $LaPO_4$ not annealed (1) and annealed at 800°C (2) nanoparticles.

Experiment

Size and morphology characteristics of the $LaPO_4$ nanoparticles were studied using SAXS and TEM techniques. Low-temperature (10 K) of self-trapped exciton (STE) luminescent properties of pure $LaPO_4$ nanoparticles with different size (8-50 nm) studied under vacuum ultraviolet and ultraviolet synchrotron radiation (3.6 – 20 eV) emitted from DORIS III storage ring at SUPERLUMI station, HASYLAB (DESY, Hamburg).

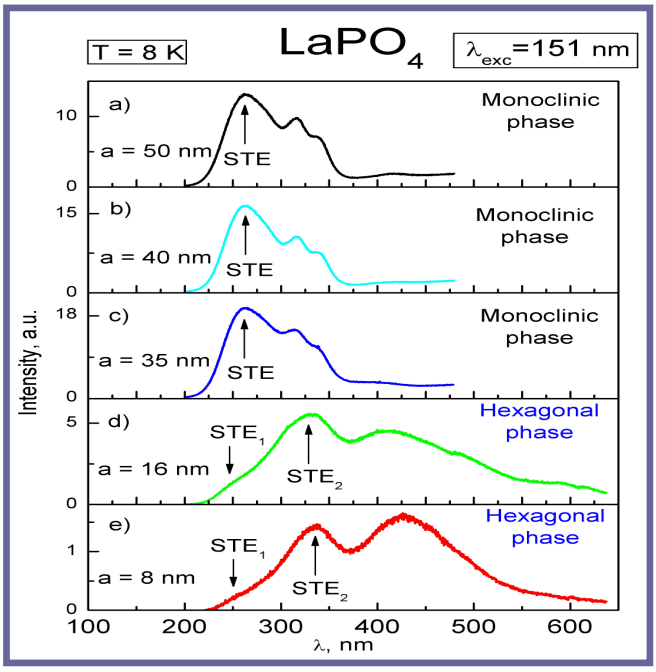

Fig. 3 Emission spectra of $LaPO_4$ nanoparticles with different sizes at 8 K.

References

[1] G. Stryganyuk, D.M. Trots, A. Voloshinovskii, T. Shalapska, V. Zakordonskiy, V. Vistovskyy, M. Pidzyrailo and G. Zimmerer. Journal of Luminescence 128 (2008) 355-360.