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ON THE EMISSION OF ANTIMONY CENTERS IN $SrCl_2$ SINGLE CRYSTALS

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Abstract. We give out the results of the emission and excitation spectra of Sb^{3+} centres in $SrCl_2$. The measurements are made at 78 K. The complex spectral distribution of the emission band at 78 K is explained with the formation of many types of emitting centres.

Резюме. В работе представлены результаты спектров излучения и возбуждения Sb^{3+} центров в $SrCl_2$. Измерения выполнены при 78 К. Сложная структура спектрального распределения эмиссионной полосы при 78 К объясняется образованием нескольких типов излучающих центров.

1. Introduction

The ions Sb^{3+} belong to the s^2- ions, most of which are well-known as activators of alkali halides. The incorporation of Sb^{3+} in the alkali halide crystal lattice is impeded because of the considerable difference in the electric charges of the cation in the host lattice and Sb^{3+} impurity ions. This is a way to explain the few articles dedicated to the investigation of the spectral characteristics of Sb^{3+} incorporated in alkali halides [1–3]. Easier introduction of the above-mentioned Sb^{3+} ions can be performed by choosing other ion crystal lattices with larger cation electric charge. Most similar to alkali halides are the alkali earth halides. The present work reveals data on the emission and excitation spectra of $SrCl_2$-Sb single crystals. As far as we know there are no published data about $SrCl_2$-Sb in the literature so far.

2. Experimental Procedure

Single crystals of $SrCl_2$ (Suprapur, Merck), preliminary dried, were obtained by horizontal Bridgman method [4]. Single crystal plates were cut in $10 \times 10 \times 2$ mm dimensions. They were heated at 700°C in vacuum in the presence of Sb metal for 18 hours and polished in order to avoid the formation of surface centres. Before

measurements the samples were quenched for 30 min at 750°C. The measurements were performed according to the method described elsewhere [5]. All necessary corrections in the spectra are made.

3. Results

The emission spectra of the investigated $SrCl_2$-Sb single crystals measured at 295 K and 78 K are presented in Fig. 1. The emission intensity at 295 K is relatively weak. The spectrum involves the 4–2 eV (300–500 nm) region. The emission is about five times more intensive at 78 K and has maximum at 3.17 eV (391 nm). The deformations of the emission band half-width indicate the coexistense of several closely situated overlapping bands. The excitation spectrum of integral emission measured at 78 K is given in Fig. 2. The spectrum consists of a band with maximum at 6.08 eV.

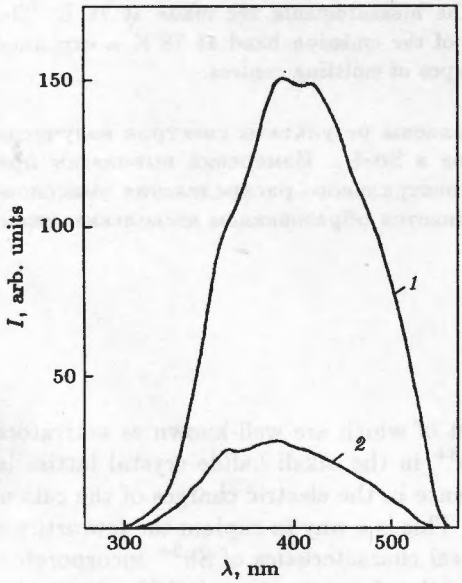

Fig. 1. Emission spectra of $SrCl_2$–Sb single crystals at: 1–78 K; 2–295 K

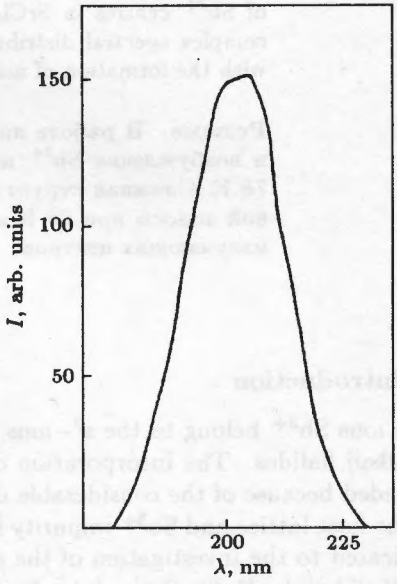

Fig. 2. Excitation spectrum of $SrCl_2$–Sb at 78 K

4. Discussion

One can assume that during the phosphor yield the emitting Sb^{3+} centres are formed, wherein the impurity ions replace the cations of the host crystal lattice. To compensate an excessive electric charge of Sb^{3+}, the equivalent amount of cation vacancies must be formed. The different localization of these vacancies near to Sb^{3+} enables the formation of centres which vary in their composition and structure. The introduction of cation vacancy as a first neighbourhood to Sb^{3+} could lead to the

formation of anisotropic centres. Besides, it can be assumed that small quantities of isotropic Sb^{3+} centres with O_h symmetry in the host lattice are formed. The coexistance of several types of emitting centres can explain the complex structure of the investigated $SrCl_2$–Sb emission spectra. The band observed in the excitation spectrum of the emission is probably related to the long-wave region of the activator's absorption.

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