ENERGY AND STRUCTURE OF THE EUROPIUM IMPURITY EMISSION CENTERS IN THE PWO CRYSTALS

O. Chukova, S. Nedilko, V. Scherbatskyi

Physics Faculty, Kyiv National Taras Shevchenko University, Kyiv, Ukraine
E-mail: chukova@univ.kiev.ua

Effects of some impure RE ions (Eu^{3+} ions are among them) on the centers of intrinsic emission of the PWO crystals have been shown by us recently [1, 2] and formation of several types of emission centers on the basis of the RE^{3+} ions in the PWO crystals was discussed in the above noted papers. Two types of emission centers formed by the RE^{3+} ions were described formerly for the PWO crystals doped with Pr^{3+} [3] and Tb^{3+} [4] ions. From the other hand, authors [5] have reported recently about three types of centers formed by the Eu^{3+} ions in the the PWO - Eu^{3+} crystals annealed at various temperatures and only one type of centers was found for the crystals before annealing. Thus, question about features and number of the emission centers formed by the RE ions in the PWO crystals is still under discussion that requires additional investigation.

This paper is directed on investigation of spectroscopy properties and energy structures of the Eu^{3+} emission centers in the PWO crystal matrix. Spectral-luminescent properties of the lead tungstate crystals doped with the Eu^{3+} ions were investigated in a wide temperature range at different excitation and registration wave lengths. The spectra consist of both weak wide nonstructural bands of the matrix emission and narrow spectral lines caused by inner *f-f* electron transitions in the impurity Eu^{3+} ions.

Both the possible ways of the Eu^{3+} ions incorporation into the PWO crystals lattice and effects of the matrix on the Eu^{3+} luminescence were discussed. It is well known that distribution and intensities of the inner *f-f* transitions in the RE ions depend on the crystal field symmetry and strength. More than 60 spectral lines corresponded to luminescence of the impurity Eu^{3+} ions were observed and have been analyzed. Excitation spectra also were measured. The analysis and interpretation of spectral lines observed in excitation and luminescence spectra have shown formation of at least two different types of luminescent centers on the basis of the Eu^{3+} ions in the $PbWO_4$ crystals. These two types of centers are considered as caused by arrangement of the impurity Eu^{3+} ions in Pb sites as well as in W sites of host matrix. Values of S^2 scalar crystal field strength, B_0^2 and B_2^2 crystal field parameters were estimated and local site symmetries were considered for the both types of centers.

References

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