MITT.ÖSTERR.MINER.GES. 149 (2004)

SPECTROSCOPIC CHARACTERISATION OF $YAl_3(BO_3)_4 : Gd^{3+}$ CRYSTALS

Watterich, A.[1], Beregi, E.[1], Aleshkevych, P.[2], Borowiec, M.T.[2], Zayarnyuk, T.[2] & H. Szymczak[2]

[1] Research Institute for Solid State Physics and Optics, Konkoly-Thege M. út 29-33, 1121 Budapest, Hungary
[2] Institute of Physics, Polish Academy of Sciences, Al. Lotników 32/46, 02-668 Warsaw, Poland
e-mail: watter@szfki.hu

Yttrium aluminium borate is a non-linear optical material with excellent chemical and physical properties. It is a possible self-frequency-doubling UV-VIS laser material when doped with rare earth ions. The aim of this work is to characterise the Gd^{3+} in $YAl_3(BO_3)_4$ single crystals with EPR and optical spectroscopy. $YAl_3(BO_3)_4$ belongs to the double borates having a trigonal structure with space group R32. There are two different boron sites (with C_3 and C_2 point symmetry, respectively), three differently oriented but energetically equivalent Al sites (C_2 symmetry) and only one Y site with D_{3h} symmetry.

0.01 Gd/ $YAl_3(BO_3)_4$ molecule was added to the starting material and the crystal samples were grown from $K_2Mo_3O_{10}$-B_2O_3 flux by High Temperature Top Seeded Solution Method.

The angular variation of EPR spectra of Gd^{3+} was measured in two different planes: around the *c* axes the spectra are isotropic, however, rotating from *c* to *a* crystallographic axis, strong anisotropy is observed. The D_{3h} symmetry of the EPR spectra for Gd^{3+} ions unequivocally means that the dopant ion substitutes for Y. The angular variation data are fit and the spin Hamiltonian parameters are determined.

The optical absorption of Gd^{3+} has three groups of bands in the UV range attributable to $^8S_{7/2} \rightarrow {}^6D$, ^6I and ^6P transitions, respectively. Relatively strong luminescence is observed at 314.4 nm due to $^6P \rightarrow {}^8S_{7/2}$ transition, when excited at the above absorption bands.

This research was partly supported by the National Science Research Fund (OTKA, Hungary, T-37669 and T-34176).