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WHITE BEAM SYNCHROTRON RADIATION AND CONVENTIONAL X-RAY TOPOGRAPHY OF GdCOB:Y CRYSTAL

E. Wierzbicka [1,2*], J. Gronkowski [2], M. Lefeld-Sosnowska [2], and J. Härtwig [3]

[1] Institute of Electronic Materials Technology, 01-919 Warsaw, Poland
[2] Institute of Experimental Physics University of Warsaw, 00-681 Warsaw, Poland
[3] E.S.R.F., BP220, 38043 Grenoble, France

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**) e-mail: eolsz@fuw.edu.pl*

The non-linear optical (NLO) crystals are very important for the development of all solid state lasers. Visible and UV solid state lasers are used for industrial or medical applications.

The promising crystals in this fields are from the family of rare earth calcium oxyborates $ReCa_4O(BO_3)_3$ (ReCOB), where Re = La^{3+}, Gd^{3+}, Sm^{3+}, Y^{3+}, Nd^{3+}, Er^{3+}. Their crystal structure belongs to the monoclinic system with the space group *Cm*. The excellent non-linear optical (NLO) properties of these crystals allow its application for frequency conversion. Moreover, they can be grown by the Czochralski technique [1, 2]. The crystals are non-hygroscopic, easy to polish and of high hardness. There exist many studies about its optical properties [3].

In particular, GdCOB: 22% at. Y is one of the most attractive non-linear optical crystal. Phase-matched second and third harmonic generation in Nd:YAG laser at room temperature is possible in these crystals [4].

The non-linear optical properties of those crystals depend on their crystalline quality. Crystal lattice defects cause lattice strain which change the optical properties (*e.g.* reflective indices).

Extended crystal lattice defects in non-doped GdCOB crystals have been revealed for the first time by X-ray transmission topography in [5, 6]. Conventional, monochromatic beam SR and white beam SR X-ray topography, all in back-reflection geometry, have been successfully applied to thick GdCOB crystals in [7, 8].

The aim of this paper was the investigation of extended defects in GdCOB: 22% at. Y.

The contrasts of long straight dislocations of strong edge components were observed (D1) in topographs of GdCOB:Y. A practically dislocations free circular region can be seen in the sample centre (core). Black contrasts of circular shape corresponding to inclusions were observed as well. Topographs revealed dislocation loops generated around the inclusion. The very weak diffraction contrasts of segregation fringes can be recognized.

The diffraction contrasts of dislocations (D1) depend on the absorption of X-rays in crystal (exactly on the value of μt). In topographs obtained for $MoK\alpha_1$ (μt = 3.4) we can observe black or white diffraction contrasts (Fig. 1). The synchrotron topographs ($\mu t < 0.6$) allowed receiving only a black diffraction contrast (Fig. 2). The explanation of these features of diffraction contrasts is possible according the dynamic diffraction theory for weakly deformed crystals, taking into account the absorption effects.

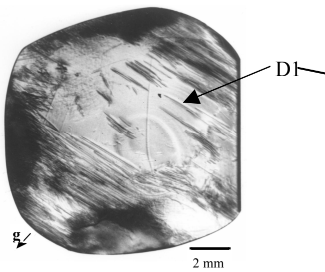

Figure 1. X-ray transmission projection topograph of sample GdCOB: 22% at. Y, $MoK\alpha_1$ radiation: 400 reflection, μt = 3.4.

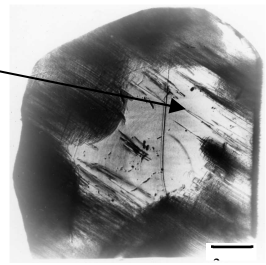

Figure 2. SR White beam transmission topograph, of sample GdCOB: 22% at.Y, λ = 0.1673 Å, $5\bar{1}1$ reflection, μt < 0.6).

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