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Investigation of Thermal and Spectroscopic Properties of YCOB and Re:YCOB (Re=Nd, Yb) Crystals.

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$YCa_4O(BO_3)_3$ (YCOB), $(Nd_{0.05}Y_{0.95})Ca_4O(BO_3)_3$ (Nd:YCOB) and $(Yb_{0.2}Y_{0.8})Ca_4O(BO_3)_3$ (Yb:YCOB) were grown by the Czochralski method and crystallographic, spectropic and thermal properties of these crystals were investigated.

The grown parameters to get high quality of single crystals were 2 mm/h of pulling rate and 15~20 rpm of rotation rate under N_2 atomosphere. When the grown parameters were deviated from optimal conditions, defects gradually increased, The defects, for example, inclusions and bubbles were formed along the growing direction because borate was evaporated during the crystal growth. X-ray structure analysis of YCOB, Nd:YCOB and Yb:YCOB single crystals showed that all as-grown crystals belonged to monoclinic structure (space group Cm). The calculated lattice parameters of YCOB crystal were a = 8.043Å, b = 16.180Å, c = 3.505Å and cell volume 447.807$Å^3$.

For the fabrication of laser devices, we determined relationship between optic and crystallographic axes by using the polarizing microscope and XRD. The results were that angle of optic axis X relating to crystallographic axis c was 12° and that of Z relating to a axis was 23° .

From the transmission spectra of grown crystals, absorption edge of YCOB, Nd:YCOB and Yb:YCOB crystals was 200, 213 and 236nm, respectively. The thermal expansion coefficients of YCOB measured by thermomechanical analyser(TMA) from

320 to 650K were 5.5×10^{-6}, 5.5×10^{-6}/K and 13.5×10^{-6} correspondig to crystallographic axes a,b and c respectively. That of Nd:YCOB and Yb:YCOB were 9.3×10^{-6}/K, 5.7×10^{-6}/K, 14.8×10^{-6}/K and 12.1×10^{-6}/K, 5.9×10^{-6}/K, 12.9×10^{-6}/K. Also specific heat of YCOB, Nd:YCOB and Yb:YCOB crystals measured by differential scanning calorimetry (DSC) was 0.166, 0.170 and 0.162 cal/g · K at 330K.