2-inch size Czochralski growth and scintillation properties of Mo co-doped $Ce:Gd_3Ga_3Al_2O_{12}$ (GAGG)

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Scintillator materials combined with photodetectors are used to detect high energy photons and accelerated particles in medical imaging techniques, high energy and nuclear physics detectors, high-tech industrial applications and most recently also in the advanced homeland security related techniques. Oxide materials based on garnet structure single crystals are promising candidates for scintillator applications because of well mastered technology developed for laser hosts and other applications, optical transparency and easy doping by rare-earth elements. After a decade of R&D of the garnet type single crystal scintillators, our group reported about $Ce:Gd_3Al_2Ga_3O_{12}$ (GAGG) single crystal and scintillation response of about ～90 ns at emission around 520 nm, excellent light yield of about 56000 photon/MeV, and density of 6.63 g/cm^3[1,2,3]. And co-doping effects of various cations such as Mg^{2+} and Li^+ on Ce:GAGG were also reported[4,5]. Recently, the Mo co-doped Ce:GAGG single crystals were grown by micro-pulling down (μ-PD) method and their scintillation properties were investigated.[6]

The 2-inch size Ce:GAGG and Mo co-doped Ce:GAGG single crystals were prepared by the Czochralski (Cz) method. Absorption and luminescence spectra were measured together with several other scintillation characteristics, namely the scintillation decay and light yield to reveal the effect of Mo co-doping. Comparing to Ce^{3+} only doped GAGG, Mo co-doped crystal shows a clear improvement in light yield same as previously investigated μ-PD grown GAGG samples. Details of large size crystal growth and changes in scintillation properties with Mo co-doping will be discussed.

References

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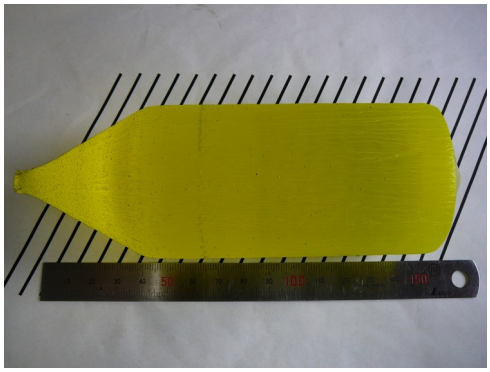

Fig. 1. 2-inch diameter Mo co-doped Ce:GAGG crystal grown by the Cz method.