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Observation of New Photoluminescence Emission in the YAG Structure and Its significant Effects on the Material Optical Properties[1]

FARIDA SELIM, CHRISTOPHER VARNEY, SHERIF REDA, DAVID MACKAY, Washington State Uiversity — Yttrium Aluminum Garnets, $Y_3Al_5O_{12}$ (YAG) are widely used as host materials for transition and rare earth elements in laser, optoelectronic and scintillation applications. They are the most important solid state laser host materials and the most promising scintillation materials. New photoluminescence peaks were observed at 700 and 800 nm in undoped yttrium aluminum garnet (YAG) single crystals. This luminescence has great effects on the optical properties of rare-earth doped YAG crystals and their performance in laser and scintillation applications. Photoluminescence measurements revealed a number of luminescence peaks in all YAG crystals regardless of the growth conditions due to native defects and low-level impurities. The strong 700 and 800 nm emissions were attributed to low level of iron impurities as confirmed by Glow Discharge Mass Spectrometry analysis. This study reveals that iron is a native impurity in all YAG crystals that plays a significant role on modifying the optical and scintillation properties of this important class of photonic materials.

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