Novel borate-based crystalline materials for efficient generation of red light

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Borate-based single crystals have attracted wide range of research interests world-wide due to their abilities to be utilized in the arena of non-linear optics, photoluminescence-based devices, dosimetry, and etc. Polycrystalline samples of yttrium calcium borate ($Y_2CaB_{10}O_{19}$) and europium doped yttrium calcium borate (Eu^{3+}:$Y_2CaB_{10}O_{19}$) were prepared by the conventional solid-state reaction method for the first time by our research group. X-ray diffraction patterns reveal that both the prepared polycrystalline materials exhibit the monoclinic crystal system. The thermal behavior of the samples were recorded using the TG-DTA measurements. Since the materials exhibit a congruently melting behavior, Czochralski crystal pulling technique was adopted to grow the single crystals. The growth parameters such as rotation and the translation rates were optimized to be 15 rpm, and 0.5-0.9 mm/h respectively. The UV-Visible-NIR study was undertaken to identify the optical bandgap of the prepared samples. The absorbance spectra clearly denote the characteristic absorptions of the europium ion. The fourier transform infrared (FTIR) spectroscopy (FTIR) results indicate the presence of the functional groups due to the boron-oxygen network in the grown samples. The photoluminescence studies on the grown europium doped yttrium calcium borate crystals indicate their potential in the efficient generation of red colored radiation. The results of the photoluminescence analysis, decay time measurements, determination of correlated color temperature and color rendering index, and color purity shall be discussed in detail during the presentation.