

Abstract:

The research work entitled “Effect of Growth Processes on Characteristics of Some Technologically Important Oxide and Halide Crystals” dwells on the growth of single crystals of a few materials that find applications as scintillator detectors and radiation dosimeters. The effect of growth parameters on their characteristics has been investigated mainly to improve their properties for the intended applications. In this thesis three different kinds of approaches covering a broad field of material synthesis and single crystal growth employing different techniques were investigated. The effect of growth process on crystal growth and scintillation properties of Tl doped CsI has been established. Crystals were grown employing two methods, namely gradient freeze technique and the modified Bridgman technique. The grown crystals were subjected to different heat treatments to improve their scintillation properties. The technology to grow high quality, large size (55 mm diameter x 75 mm Length) alkali halide crystals, developed during the course of this work is available for transfer to industry. In oxide materials sodium double tungstate crystals were taken for the study. The single crystals were grown by the Czochralski technique under varying ambient conditions. The post-growth heat treatment under various ambient was successfully used to tailor the fluorescence and optical properties of the grown crystals. It was found that oxygen has a high mobility at elevated temperatures in the double tungstates that makes them sensitive to ambient conditions during the growth. A process to fabricate OTC of $\text{CaF}_2:\text{Mn}$ was developed during the course of this work . It was demonstrated that the synthesis of $\text{CaF}_2:\text{Mn}$ OTC at lower temperatures and under a reducing ambient facilitates the incorporation of Mn in relatively higher amounts and minimizes the oxygen contamination, thus improving the TL-properties significantly.