

Single step thermal treatment synthesis and characterization of lithium tetraborate nanophosphor

ABSTRACT

This study includes the synthesis of nano-sized lithium tetraborate by an innovative single step thermal treatment method and characterization of the products. The heating temperature for the synthesis was varied between 200 and 850 °C with the retention time of 2 h. Polyvinyl pyrrolidone (PVP) with different concentrations was used as surfactant. Characterization of the samples was achieved by thermogravimetric analysis (TGA), derivative thermogravimetry analysis (DTG), differential scanning calorimetry (DSC), Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD), transmission electron microscopy (TEM) techniques and UV–vis spectroscopy. Thermal analysis of initial solution allowed the optimization of the heat treatment program and showed that the thermal stability of samples is started at 460 °C. FT-IR, XRD and TEM results proved the formation of pure nano-crystalline lithium tetraborate at temperature between 460 and 750 °C. Furthermore, the band gap investigation was performed using UV–vis spectra in the presence of different concentrations of PVP and in variety of calcination temperatures. The estimated optical bandgap was found to be between 5.2 and 6.2 eV.

Keyword: Nanolithium tetraborate; Single step thermal treatment; PVP capping agent; Slow separation nucleation; Band gap