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Synthesis, structural, thermal and mechanical properties of 1,10-Phenanthroline-3-carboxy-4-hydroxy benzene sulphonate crystal: An efficient SHG material with a high laser damage threshold for NLO applications

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Abstract

Nonlinear optical material, 1,10-Phenanthroline-3-carboxy-4-hydroxy benzene sulphonate (PCHBS) has been synthesized and single crystals grown by slow solvent evaporation solution growth technique in methanol as the solvent. The ^1H and ^{13}C NMR spectra were recorded to establish the molecular structure. The single crystal XRD analysis reveals that the title salt crystallizes in monoclinic crystal system with non-centrosymmetric space group, $P2_1$. The presence of various functional groups was confirmed by FT-IR spectroscopic studies. The UV-vis-NIR was recorded in the range 200-1200 nm to find the optical transmittance window, lower cut off wavelength and optical band gap. The thermal and mechanical properties were estimated by TG/DTA analysis and Vickers microhardness study, respectively. The SHG efficiency of title crystal was measured by employing modified Kurtz and Perry powder technique. Further, the laser damage threshold value has been determined using a Q-switched Nd:YAG laser operating at 1064 nm.

Keywords: Organic, Crystal structure, X-ray techniques, Thermal properties, Functional, Optical materials and properties

1. Introduction

The development of the novel NLO materials has been strongly emphasized owing to their widespread applications in the field of laser technology, optical communication and data storage [1, 2]. Moreover, low optical loss, high thermal and mechanical stabilities and large nonlinear optical susceptibility are the most important requirements of any nonlinear optical crystal for potential

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