

Fluorescence and Optical Studies of Sodium Carbonate Boric Acid - ANLO Single Crystal

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Abstract: The single crystals of sodium carbonate borate (SCB) were grown by evaporation technique. The crystallinity of SCB was determined using powder XRD. The optical characteristics of SCB are investigated using UV-Vis spectral measurements. At 650 nm, a significant red emission was found in the SCB fluorescence spectrum. Microhardness testing was used to determine the sample's mechanical strength.

Keywords: XRD, FTIR, Fluorescence, Microhardness

I. INTRODUCTION

Nonlinear optics is important in emerging photonic and optoelectronic technologies [1-3]. Nonlinear optical (NLO) materials offer a wide variety of applications in laser technology and optical modulation because they can create large values of original frequency [4-6]. Amino acids are intriguing materials for NLO applications because they contain the proton donor carboxyl acid (-COO) group and the proton acceptor amino (NH₂) group [7]. The mechanical and optical properties of the SCB were grown after it was synthesised.

II. CRYSTAL GROWTH OF DGCC

The sodium carbonate and boric acid salt was dissolved in distilled water and allowed for crystallization. The good quality single crystal with a dimension of 10×5×2mm³ was cultivated within 20 days (Fig. 1).

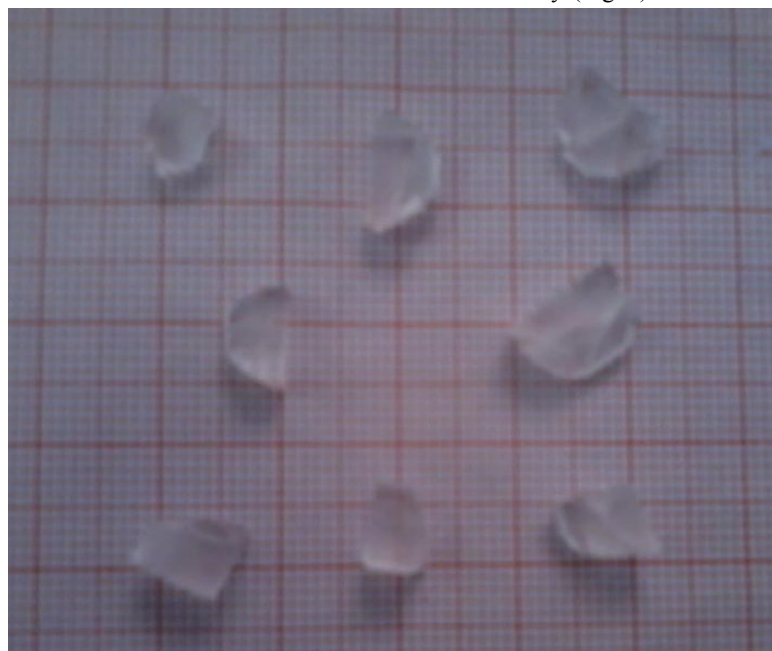


Figure 1: Grown crystal of SCB.

III. RESULT AND DISCUSSIONS

3.1 Powder XRD

Using the XPERT-PRO Diffractometer equipment with CUK ($\lambda = 1.5444$) radiation, the powder XRD pattern of SCB was observed (Fig. 2). The XRD pattern of SCB reveals a strong intensity peak, indicating that the crystalline nature.

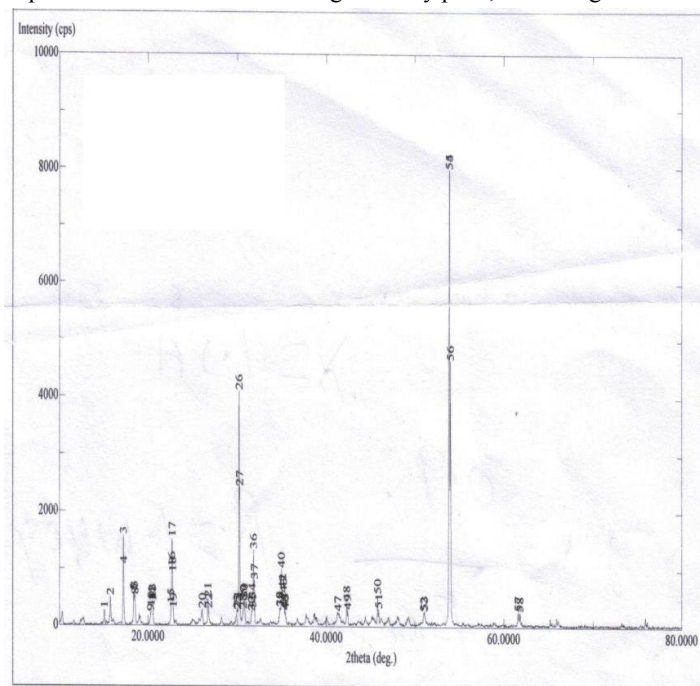


Figure 2: Powder XRD of DGCC

3.2 UV-Vis Transmittance Study

SCB's UV-Vis spectrum was measured between 190 - 1100 nm (Fig.3& 4). SCB has a lower cutoff wavelength of 320 nm and a transmittance window of 320-1100 nm, making it suitable for optical applications. [7].

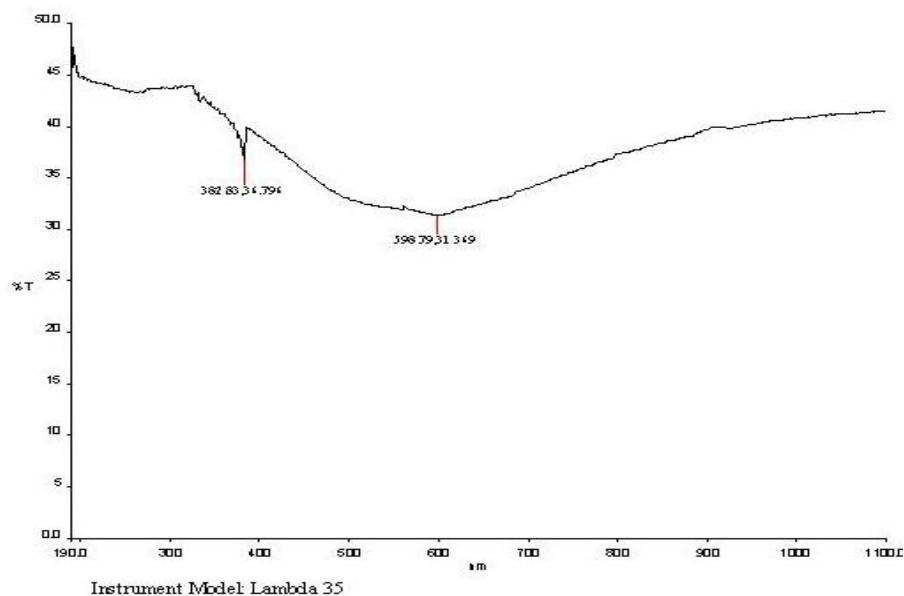


Figure 3: UV-Vis Transmission Spectrum.

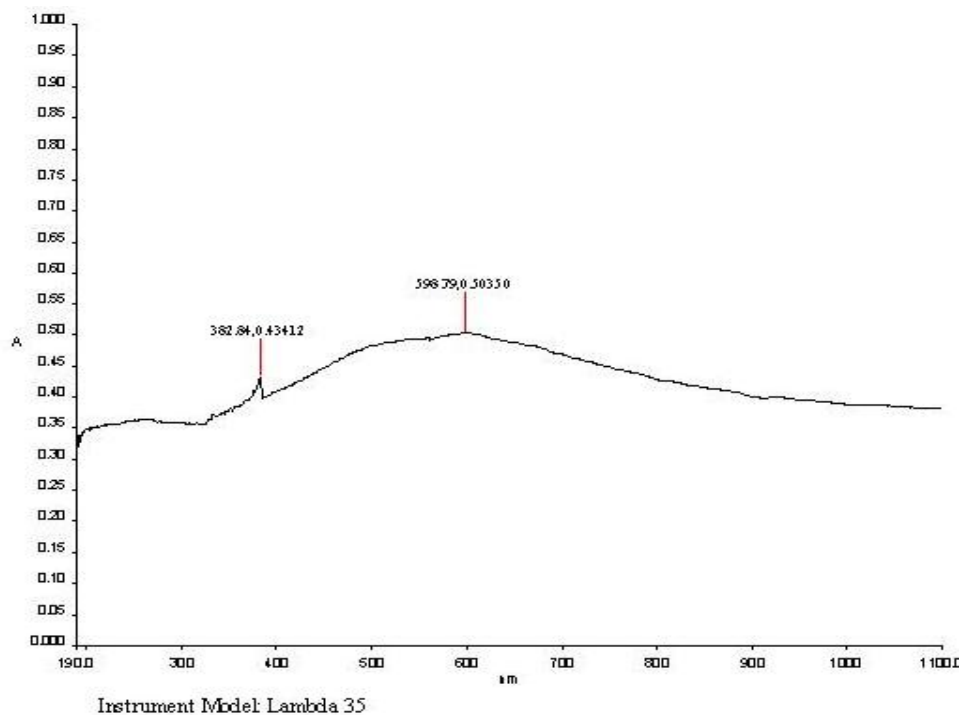


Figure 4: UV-Vis Absorption Spectrum.

3.3 Fluorescence Spectral Studies

With an excitation wavelength of 310 nm, the fluorescence spectrum of SCB was recorded using perkinelmer spectroscopy (Fig. 5). At 353 nm, there is a strong violet emission. The emission of blue light is indicated by the peak at 406 nm and the peak at 685 nm emits relatively little red light, it's perfect for photonic systems.

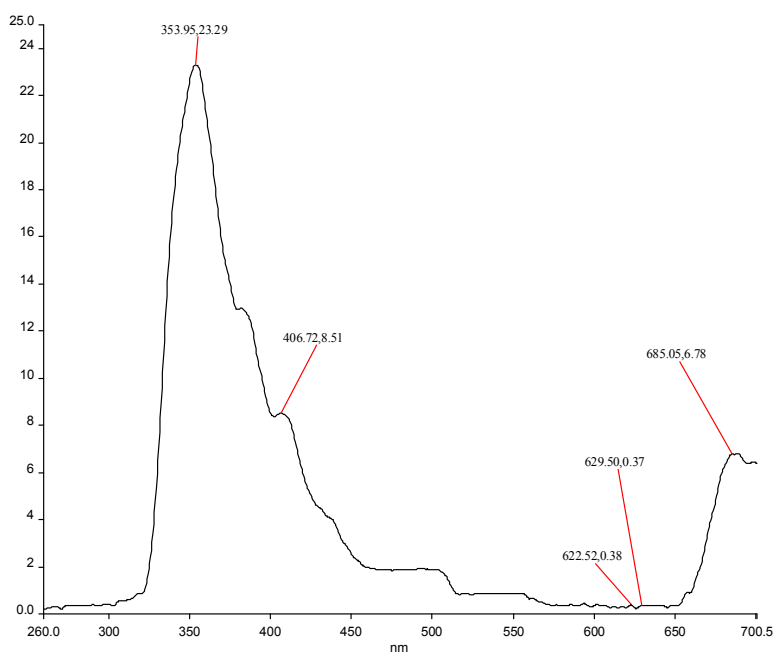


Figure 5: Fluorescence spectral studies.

3.4 Micro Hardness Measurement of Sodium Carbonate Borate

Microhardness measurement of sodium carbonate borate was carried out using Shimadzu HMV- 2 fitted with Vickers pyramidal indenter and attached to an incident light microscope. Hardness number is increases with increasing load (Fig. 6). The work hardening coefficient (n) of the SCBis2.8 considered to be soft material (Fig. 7).

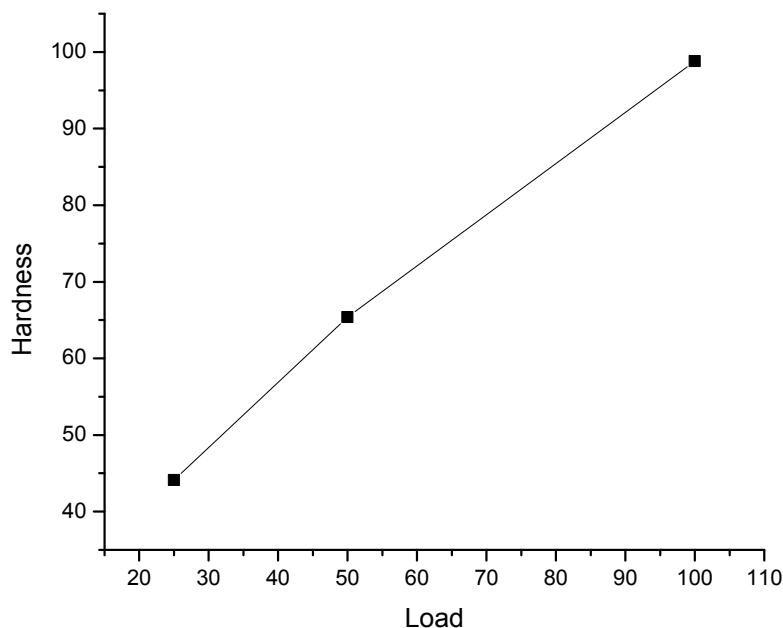


Figure 6: Load vs Hardness Number

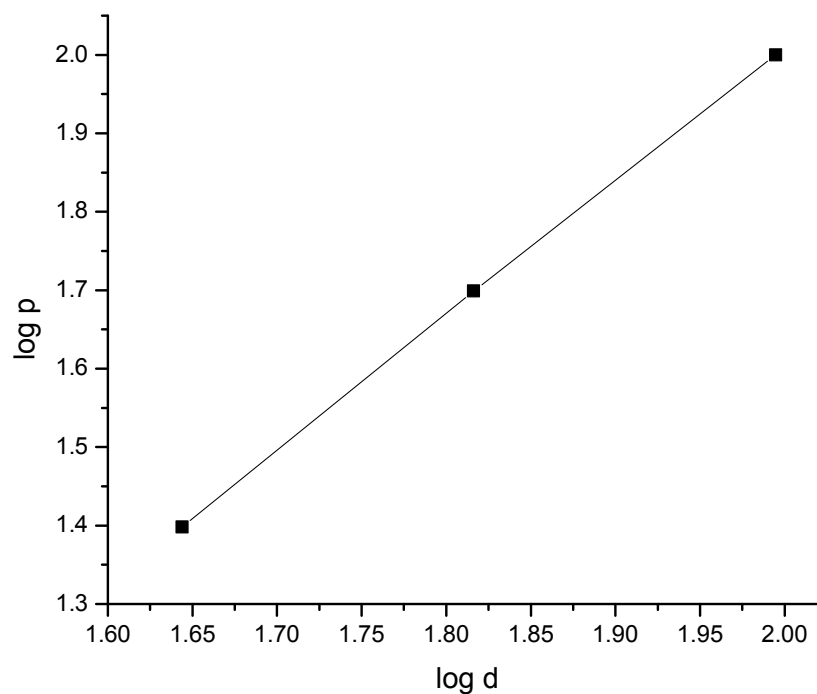


Figure 7: log P vs log d.

IV. CONCLUSION

The SCB single crystals were cultivated by growth technique and the crystallinity nature was confirmed by powder XRD analysis. The transmittance spectrum shows the lower cutoff wavelength is around 320 nm. The Fluorescence spectrum reveals maximum red light emitted by SCB at 685 nm.

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