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# A Study on the Growth and Characteristic Properties of aSemi organic NLO material: Sodium Chloride doped Glycine Crystals

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**Abstract:** Single crystals of Sodium Chloride doped Glycine (SCG), a semi organic nonlinear optical crystal has been grown from solution by slow evaporation at room temperature. The expected functional groups of the title compound were confirmed by the FTIR spectral analysis. The crystalline nature and its various planes of reflections were observed by the powder XRD. The optical quality of SCG crystals identified by UV-Visible studies. The amount of chlorine substitution on glycine is found from SEM-EDX. The electrical conductivity of the grown NaCl doped glycine crystals were determined by dielectric studies. The efficency of SHG was confirmed using the Kurtz powder technique.
**Keywords**: Semi organic, Nonlinear optical, Slow evaporation, SEM-EDX.

## 1. Introduction and Experimental

### 1.1. Introduction

Nonlinear optical (NLO) materials have long been known to interact with light, to produce a nonlinear response and the composition of these materials, generally falls into three classes, either inorganic, organic or semi organic. Especially the semi organic non linear optical materials requirements ask for a large difference in dipole moment characterizing the interaction between substituent group and electronic cloud, between the ground and excited states of the molecule organized in a non-centrosymmetric structure[1].

Glycine is the simplest of all amino acids in the crystalline form, having three different polymorphs in which the molecules exist in the dipolar form. This dipolar nature exhibits peculiar physical and chemical properties of amino acids making them ideal candidates for use in NLO[2].

## 1.2. Experimental

The Sodium chloride doped Glycine crystal was synthesized by dissolving Glycine and Sodium chloride in the ratio 2:1 in deionized water. Single crystals of Sodium chloride doped Glycine and were grown by slow evaporation technique at room temperature.

## 2. Result and Discussion

### 2.1. FTIR Spectral Studies

The powdered specimen of Sodium chloride doped glycine crystal has been subjected to FTIR analysis by PERKIN ELMER RXI Fourier Transform Infrared Spectrophotometer using KBr pellet technique in the wavelength range between 400 and 4000 $cm^{-1}$. The recorded spectrum of Sodium chloride doped glycine is shown in the Fig.1. The FTIR spectrum of Sodium chloride doped glycine agrees well with the literature[3].

The absorption peaks due to carboxylate group are observed at 501.38, 606.67 and 683.12 $cm^{-1}$ respectively. Similarly the absorption peaks due $NH_{3+}$ group are observed at 926.90, 1040.11 and 1490.98 $cm^{-1}$, respectively. The presence of $NO_3$ group is conformed due to absorption peak at 887.34$cm^{-1}$.Peak at 1040.11, 1392.82 and 1585.49 $cm^{-1}$ are attributed to NCN, COO- and $NH_2$ groups respectively. Others bands of COO- mode deformation were shown at 683.12, 606.67 and 501.38 $cm^{-1}$, in the spectrum.

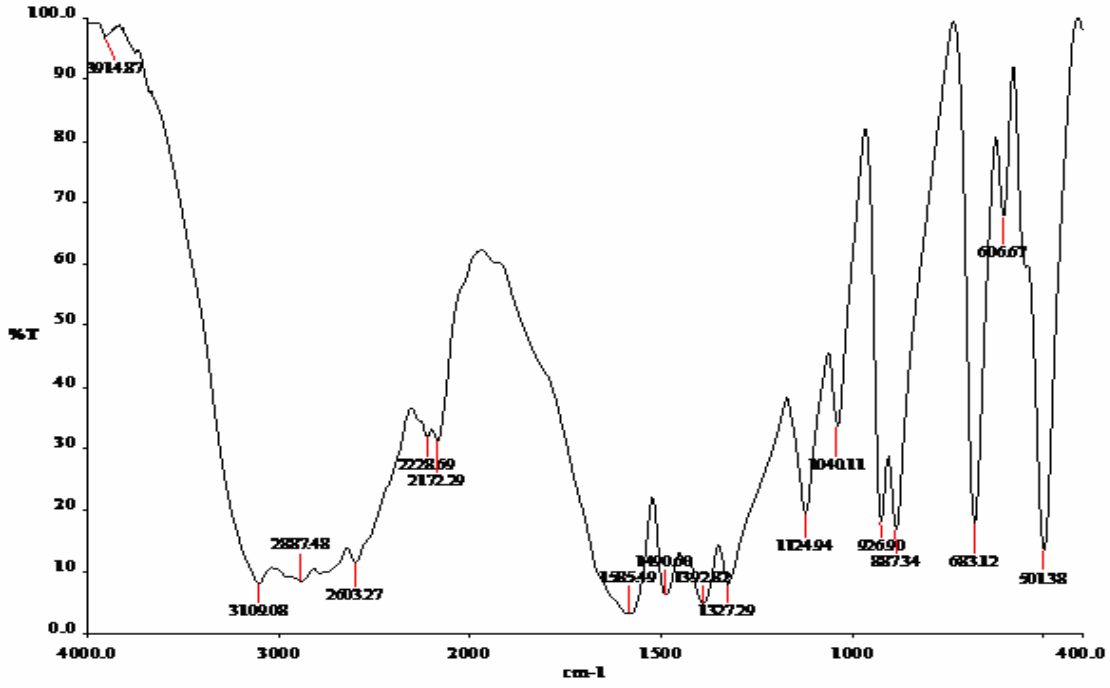


**Fig.1. FT-IR spectrum of Sodium Chloride doped Glycine crystal**

### 2.2. Powder X-Ray Diffraction

X-Ray powder diffraction analysis was carried out for the identification of the synthesized crystalline nature of SCG crystal. Powder XRD pattern was obtained using a D8 Advance BRUKER diffractometer. The sample was scanned over the range 20°-70°.

### 2.3. UV-VIS Spectrum

The UV-Vis spectrum of pure and SCG crystals were recorded in the range of 190-1100nm using LAMBDA-35 UV-Vis spectrophotometer. The UV cutoff for the grown crystal of pure glycine was found reported to be 275 nm[4]. The sodium chloride doped glycine crystal absorption shifted to 305 nm and no

absorption through the entire visible region is one of the most desired properties for the fabrication of optoelectronic devices.

### 2.4. SEM and Energy dispersive x-ray analysis

The SEM images of the crystal reveal the well formation of the faces of the crystal. Fig.2 shows the EDX spectra of 2:1 ratio of Glycine and sodium chloride doped crystals. The spectrum shows strong peaks of Carbon, Oxygen and Chlorine which indicates the presence of chlorine in the sample. The content of hydrogen cannot be measured accurately because of its low atomic mass[5].

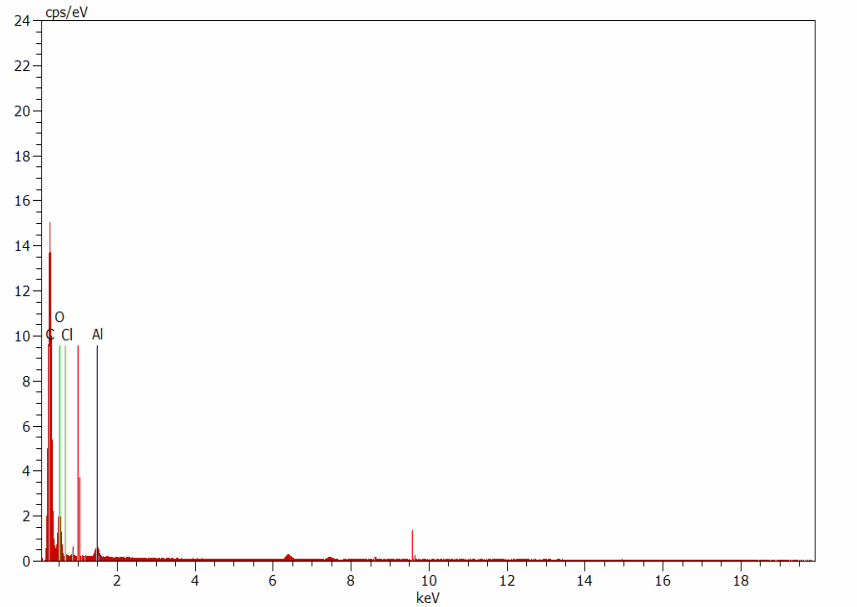


**Fig.2 Energy dispersive X-ray of SCG crystals**

### 2.5. Powder SHG Measurement

In order to confirm the NLO property, the grown crystals were powdered and subjected to Kurtz and Perry powder technique, which remains powerful tool for initial screening of materials for SHG[6]. The result obtained shows a powder SHG efficiency of SCG crystal was about 0.9 times that of KDP.

### 2.6. Electrical conductivity studies

The dielectric constant and the dielectric loss of SCG crystal were studied at 40$^{o}$C using HIOKI 3532-50 LCR HITESTER in the frequency region 50 Hz to 1 MHz. Dielectric constant varies with frequency as shown in Fig.3, it is seen that at low frequency the value of dielectric constant maximum because of space charge polarization dominant due to charged lattice defect[7].

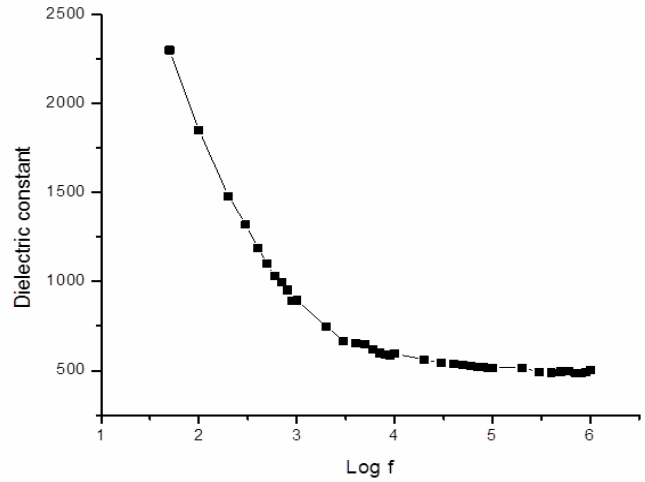


**Fig .3.** Variation of dielectric constant with logarithmic frequency

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