RJC
http://www.rasayanjournal.com

RASĀYAN *J. Chem.*
Vol.2, No.1 (2009), 49-52
ISSN: 0974-1496
CODEN: RJCABP

GROWTH AND CHARACTERIZATION OF NONLINEAR OPTICAL MATERIAL: GLYCINE SODIUM CHLORIDE

S.Palaniswamy and O.N.Balasundaram
Department of Physiscs, P.S.G.College of Arts and Science,
Coimbatore-641 014
E-mail: palazhamni_5003@yahoo.com

ABSTRACT

Single crystals of Glycine Sodium Chloride (GSC), a semi organic nonlinear optical material has been grown from solution by slow evaporation at ambient temperature. The growth of crystals has been carried out at various pH values and the growth was confirmed at pH 6. The chemical composition of the grown crystals was determined by the FTIR spectra. The crystalline nature and its various planes of reflections were observed by the powder XRD. The structure is built from alternate layers of Glycine organic molecules and inorganic layers consisting of Na^+ ions and Cl^- ions. The SHG was confirmed using the Kurtz powder technique.

Key words : I.Characterization; 2.X-ray diffraction; 3. Growth from solutions; 4.Non-linear optic materials.

INTRODUCTION

In recent years, organo-inorganic hybrid materials have attracted considerable attention. In particular, the inorganic derivatives of protein amino acids are often attributed to symmetric groups without an inversion centre mostly to polar symmetry groups. Their crystals have properties whose symmetry is described by odd -rank tensors such as pyro-electric effect, spontaneous electric polarization, piezoelectric effect, generation of second optical harmonics, etc. Moreover crystals that belong to the eleven enantiomorphic point groups, having no mirror reflection planes exhibit optical activity, which is described in terms of the axial generation tensors. While the structures of most amino acids are well defined, the structures of the derivatives of the protein amino acids with inorganic components are not. This paper defines the crystal structure of Glycine Sodium Chloride [GSC]. This has been investigated by the FTIR studies, its crystalline nature is studied by the powder XRD, the transmittance and absorbance of electromagnetic radiation is studied through UV-Visible spectrum

EXPERIMENTAL

Synthesis and crystal growth:

GSC was synthesized from analytic grade of Glycine and Sodium Chloride (Merck) in equimolar ratio and dissolved in triple distilled water. The pH of the solution at super-saturation is kept at 6.0. The solution is filtered and transferred to a Petri dish for crystallization. This compound is re-crystallized 2 times for purity. Then the pure samples of seed crystals are taken and characterized.These seed crystals were used for the growth of bulk glycine sodium Chloride crystals.

CHARACTERIZATION:

X-RAY diffraction

The grown crystals have been characterized by powder X-ray diffractometer. Fig(1) represents the powder X-ray pattern of the grown GSC. The lattice parameter values of glycine sodium chloride (GSC) taken from the literature were used for the simulation of hkl values and corresponding d values have been calculated. The single crystal X-ray diffraction analysis has been performed using the single crystal X-ray

diffractometer on glycine sodium chloride (GSC) crystals and the obtained crystallographic data are given in table1. The system is found to be monoclinic.

Measurement of melting point

The melting point of the grown crystals was found using melting point apparatus. The micro-capillary tube containing the powder sample was inserted into the melting point apparatus with a thermometer nearby. The temperature was gradually increased and the powder started to change brown in colour at 245°C and sintered at 282°C. the error in The measurement was ±1°C.

FT-IR spectra

The FT-IR spectrum of glycine sodium chloride (GSC) was recorded using FTIR spectrometer in the region 4000-400cm^{-1} and the spectrum is shown in Fig. 2.

Amino acids in the form of Zwitter ions do not show N-H stretching at 3200cm^{-1} but show a broad band between 3130cm^{-1} assigned to asymmetric stretching of NH_3 group. Absorption depends upon the structure of amino acids. Hydrochlorides of amino acids containing NH_3 group absorb between 3145 and 3050cm^{-1}. in Zwitter ions, two vibrational modes of the carboxylate ion are readily identified between 1600-1410cm^{-1}. The asymmetric vibrational band at 1600-1560cm^{-1} is broad and strong. In hydro-chlorides of amino acids, the vC=-0 absorptions are shifted to higher frequencies. In the hydrochloride of α-amino acid, C=0 stretching occurs at 1754-1724 cm^{-1}. this higher frequency absorption is due to the –I effect of NH_3 group. When NH_3 group is present in the more remote position, e.g. in δ-amino valeric acid, C=0 stretching returns to
1710 cm^{-1}. N-H deformation bands occur near 1600 cm^{-1}.

NLO TEST

NLO studies The NLO property of the crystal was confirmed by Kurtz powder technique. The determination of SHG intensity of the crystals using powder technique was developed by Kurtz and Perry[5] .The crystals are ground to powder and packed between two transparent glass slides. The first harmonic output of 1064 nm from a Nd:YAG laser was made to fall normally on the prepared sample with a pulse width of 8 ns. The second harmonic signal was not generated in the crystal was confirmed from the emission of green radiation by the sample. It is found that the SHG efficiency of the crystal is only half times higher than that in the case of KDP, which is in agreement with literature[1,4].

UV-VISIBLE SPECTRA

The UV- Visible spectrum of glycine sodium **chloride** crystals was recorded using an UV-visible spectrophotometer. The transparent behaviour of glycine sodium chloride in the entire UV visible region is clearly illustrated by its UV-visible spectrum shown in Fig.3. At 980 nm reflectance is very high. At this wave length we can use this crystal for switching activities.

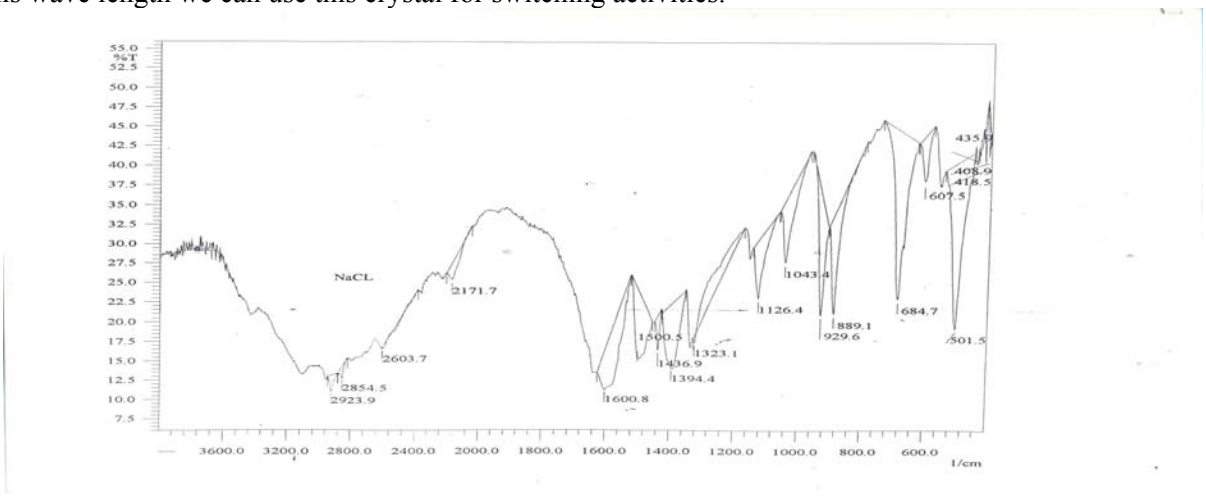

Fig.-1: Powder XRD Pattern of Glycine sodium chloride(GSC). (But the sample name is given as Sodium chloride, to hide the sample)

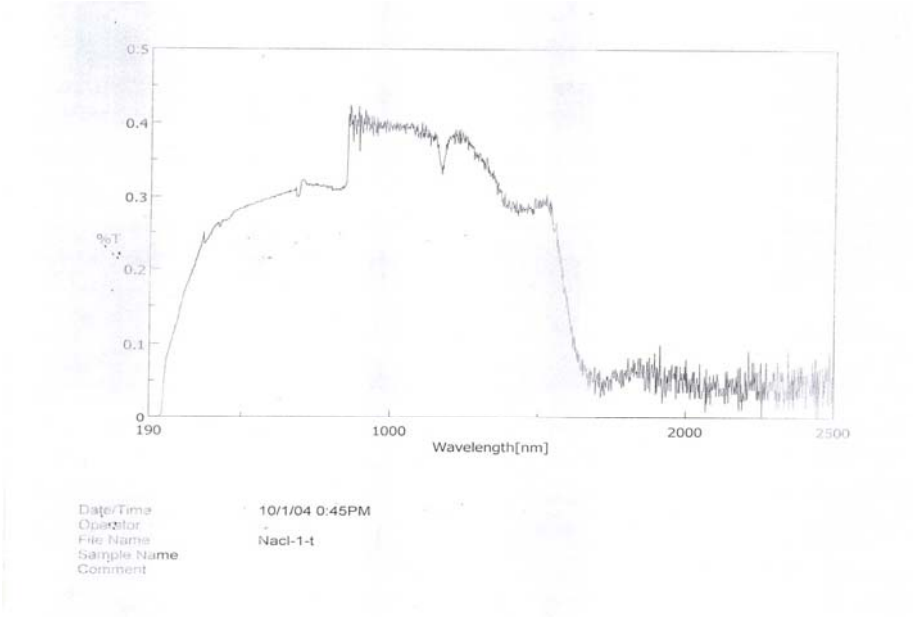

Fig.-2:FTIR Spectrum of Glycine sodium chloride. (But the sample name is given as Sodium chloride, to hide the sample)

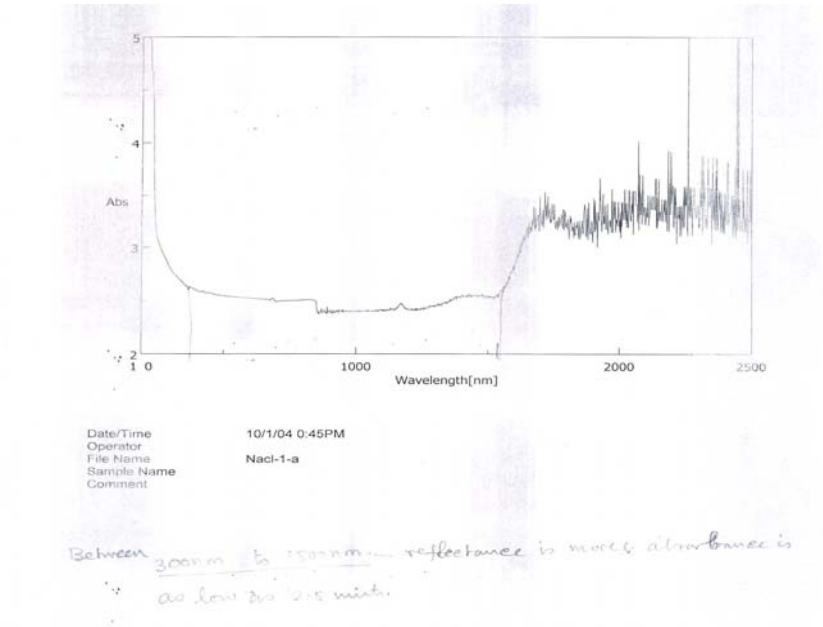

Fig.-3:UV – Visible spectra of Glycine sodium chloride. (Transmittence) (But the sample name is given as Sodium chloride, to hide the sample)

Table-1

S. No.	Peak No	Experimental Data	Standard Data	h k l values	Systems
1	12	56.4054	56.403	2 2 3	Monoclinic
2	7	31.6929	31.693	2 0 0	Cubic
3	11	45.5916	45.545	2 2 0	Cubic
4	3	21.9250	21.818	1 0 1	Hexagonal
5	4	25.0000	25.123	1 4 2	Monoclinic
6	5	25.4037	25.353	1 1 0	Hexagonal
7	6	29.1905	25.259	1 2 1	Monoclinic
8	7	31.6929	31.163	1 0 1	Monoclinic
9	8	35.8757	35.890	1 0 2	Monoclinic
10	9	38.9800	38.662	0 1 2	Monoclinic
11	10	39.1562	39.166	0 1 2	Monoclinic
12	11	45.5916	45.450	0 6 0	Monoclinic
13	12	56.4054	56.403	2 2 3	Monoclinic

REFERENCE

1. B.N. Moolya, A. Jayarama, M.R. Sureshkumar and S.M. Dharmaprakash, *J.Cryst.Growth,* **280**, 581 (2005).
2. R.K. Khanna and P.J. Miller, *Spectro Chem. Acta*, **26A**, 1667 (1970).
3. R. Silverstein, G.C. Bassler and T.C. Morrill, Spectrometric Identification of Organic Compounds, John Wiley & Sons (1991).
4. N.N. Bhat and S.M. Dharmaprakash, *J. Cryst. Growth*, **236**, 376 (2002).
5. S.K. Kurtz and T.T. Perry, *J. Appl. Phys.*, **39**, 3798 (1968)

(Received: 8 November 2008 Accepted: 14 November 2008 RJC-279)

"I am not bound to win, but I am bound to be true. I am not bound to succeed, but I am bound to live by the light that I have. I must stand with anybody that stands right, and stand with him while he is right, and part with him when he goes wrong."

-**Abraham Lincoln**