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GROWTH AND DIELECTRIC CHARACTERIZATION OF TRIGLYCINE SULPHATE (TGS) CRYSTALS ADDED WITH CADMIUM SULFIDE (CdS) NANOPARTICLES.

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ABSTRACT

Triglycine Sulphate (TGS) crystals were grown from saturated aqueous solution by slow evaporation technique.TGS crystals were also grown by the same technique by adding CdS nanoparticles to the aqueous solution. XRD studies show that both the crystals crystallize in monoclinic structure. CdS nanoparticles were synthesized by chemical route by dissolving cadmium Sulfate in deionised water.1-Thioglycerol was added during constant stirring. Ammonium sulphide was rapidly added to form cadmium sulphide nano particles. The particle size was estimated by XRD method. Curie point of TGS is not affected by addition of impurity of Cd^{2+} ions. The effect of addition of CdS nano particles on dielectric constant of TGS crystal has been reported.

KEYWORDS – Crystal Growth, CdS nano particles, Chemical synthesis, Curie point

1. INTRODUCTION

Triglycine Sulphate (TGS) is one of the most comprehensively studied ferroelectric materials [1,2]. Ferroelectric crystals with certain impurities, defects have received marked attention in the last few years [3,4]. Triglycine sulphate crystal is one of the interesting ferroelectric materials which finds applications in infrared detectors, transducers, capacitors and sensors [5,6]. It has second order phase transition at the curie point $49°C$. The properties of TGS with organic and inorganic dopants have been investigated by Lock and Keve et al [7,8]. Disadvantages of undoped TGS crystals can be overcome by adding suitable impurities to the lattice sites of TGS crystals [9,10,11]. Change in the density and hardness in TGS crystal dopped with CdS is reported by K. Balasubramanium et al [12]. The addition of alanine impurities reduces dielectric loss and dielectric constant of TGS crystal [13]. Density of NaBr doped TGS crystal increases but no change in the curie point of TGS crystal has been reported by N. Theresita Shanthi et al [14].

In the present work growth and dielectric properties of TGS crystals have been investigated by adding impurities of CdS nano particles.

TGS has been synthesized from analar grade glycine and concentrated H_2So_4 in the ratio of 3: 1respectively. Glycine should be added slowly to dilutedH_2So_4, after complete dissolution the solution is evaporated until the salt materializes. The growth of TGS crystal was carried out by solution method with slow evaporation technique at room temperature.

Solution of cadmium sulphate (2 mM) was taken in a reaction vessel and 1- Thioglycerol was added during constant stirring till the reaction is complete. Ammonium sulphide was added to the above mixture which gives rise to formation of CdS nano particles. CdS added TGS crystals are grown by adding 1 mol % CdS to saturated solution of TGS. X-ray diffraction pattern for pure TGS and

CdS added TGS were recorded. XRD study was carried out by using powered X-ray diffractometer with Cu K-alpha radiation$\lambda = 1.5405\ A°$. Dielectric measurements were carried out using parallel plate capacitor method. Stainless steel electrodes were used and silver paste was applied for good electrical contacts. Capacitance was measured by employing L-C-R meter at 1KHz frequency. Temperature ranging from room temperature to $70° C$.

2. RESULTS AND DISSCUSSION

Synthesized nano particles have good crystallintiy. Figure – 3 shows the X ray diffraction pattern of CdS nano particles synthesized in the present work. The average particle size obtained from diffraction pattern using Scherrer formula is found to be 10 -20 nm.

The obtained values of lattice parameters for pure TGS crystals are in good agreement with the earlier report. When CdS nano particles are added to TGS, slight change is observed in the lattice parameters. Cd^{2+} ions may be incorporated in the lattice of TGS.

Figure -4 shows no change in curie point temperature. Increase of dielectric constant at the curie point in TGS crystal added with CdS nano particles may be due to slight change in the domains due to Cd^{2+} impurities in the lattice.

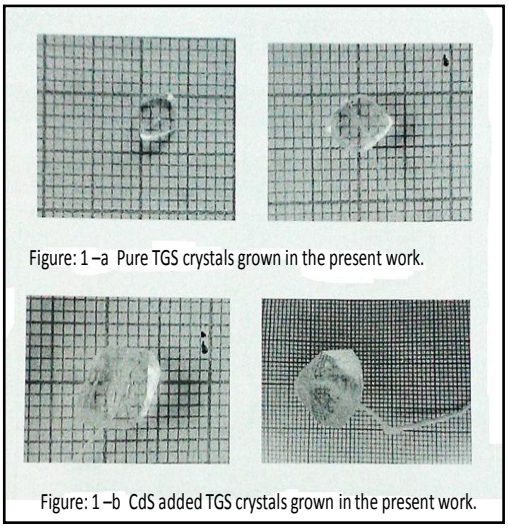

Figure: 1 –a Pure TGS crystals grown in the present work.

Figure: 1 –b CdS added TGS crystals grown in the present work.

Figure- *1*- a and **1 – b** shows the grown crystals of present work.

Table – 1: Lattice parameter values of TGS and CdS added TGS crystals.

Sample	***a*** **(*A*°)**	***b*** **(*A*°)**	***c*** **(*A*°)**	***α***(°)	***β***(°)	***γ***(°)
1. Pure TGS	9.413	12.712	4.984	90	113.07	90
2.CdS added TGS	9.445	12.755	5.812	90	115.55	90

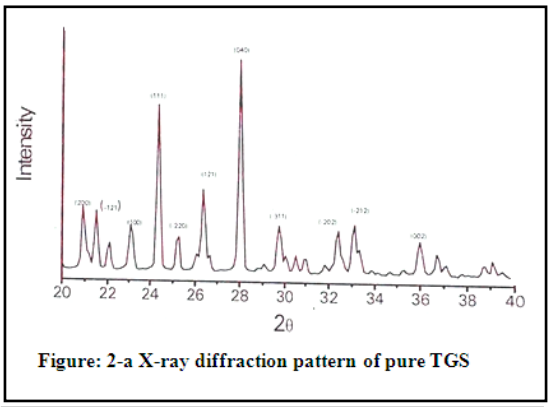

Figure: 2-a X-ray diffraction pattern of pure TGS

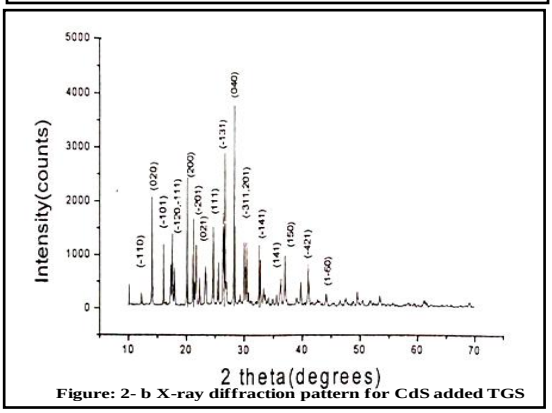

Figure: 2- b X-ray diffraction pattern for CdS added TGS

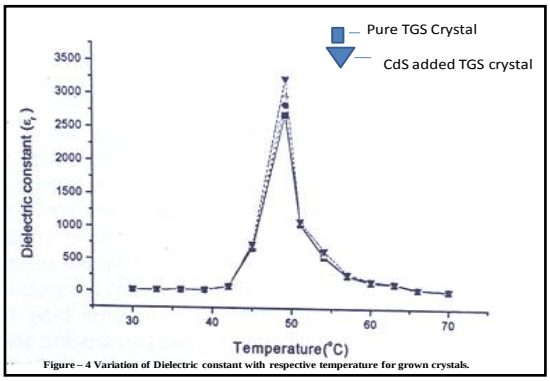

Figure – 4 Variation of Dielectric constant with respective temperature for grown crystals.

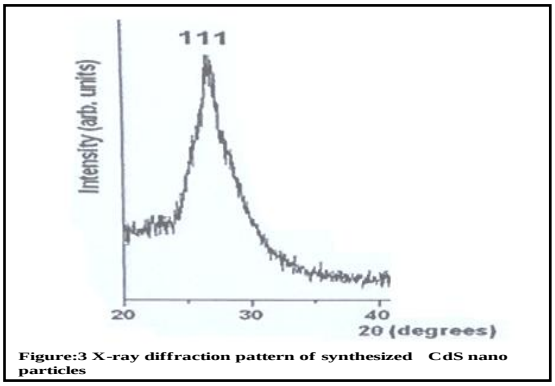

Figure:3 X-ray diffraction pattern of synthesized CdS nano particles

3. CONCLUSIONS

Pure TGS crystals were grown by solution growth method. Chemical synthesis of nano particles was carried out at room temperature. CdS nano particles added TGS crystals were grown by slow evaporation method. XRD studies reveals the

monoclinic structure of grown crystals. Dielectric studies shows that there is no change in the curie temperature when TGS crystals are added with CdS nano particles.

ACKNOLWLEDGMENT

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