Chapter 10

Concluding remarks And Future Scope

10.1 Summary

Nonlinear optics is playing a major role in the emerging photonics and optoelectronic technologies. New nonlinear optical frequency conversion materials are having a significant impact on laser technology, optical communication and optical data storage. Second order nonlinear optical materials have recently attracted much attention because of their potential applications in emerging optoelectronics technology. On account of the large flexibility for molecular design and high Non Linear Optical (NLO) efficiency there has been much progress in basic research on organic materials and organometallic solid materials. NLO properties of organometallic materials are currently under intense investigation, triggered by potential application in optoelectronics due to their incorporated advantages of both organic and inorganic materials. Molecules with donor-acceptor interactions, resulting from charge transfer between electron donating and withdrawing groups, are good candidates owing to their large dipole moment and in transition dipole moment. Some intuitive understanding of the advantages of NLO properties of thiourea co-ordination compound was found in literature. There is a small energy gap between ground and excited state and more optical absorption transitions, such as ligand to metal and metal to ligand and
charge transfer bands in the UV-Visible region. The intensities of these bands are associated with their transition dipole moment. The objectives of the present investigations were to grow the semi organic NLO crystals with enhanced SHG efficiency as compare to the reported NLO crystals which are being used for different optoelectronics applications.

In the present work the different semi organic NLO crystals such as zinc thiourea chloride (ZTC), zinc (tris) thiourea sulfate (ZTS) and bis thiourea cadmium chloride (BTCC) were grown by slow evaporation technique and dielectric constant was measured using transmission line wave guide method at frequency 8 and 12 GHz. The dielectric studies of three grown crystals viz. ZTC, BTCC and ZTS revels that dielectric constant decreases as frequency increases. Among thiourea analog crystals (ZTC, BTCC and ZTS) BTCC possess lowest dielectric constant. The low dielectric constant of BTCC at both frequencies is an added advantage for high speed electro optic modulation.

Also, ZTC, ZTS and BTCC were grown by addition of different amino acids such as L-Alanine, glycine and we observed the enhancement in SHG efficiency each time than host compound. All these grown crystals were subjected to different characterizations to study the change in the optical, thermal and structural properties. The L-Alanine was doped in zinc thiourea chloride (ZTC) and it was found
that the SHG efficiency of L-Alanine doped ZTC crystal is 4.4 times more than pure ZTC. This crystal was characterized by single crystal X-ray diffraction, FTIR, EDAX, UV-Visible study, SHG powder test, thermal analysis by using thermo gravimetric analysis (TGA). The L-Alanine and glycine was doped in ZTS and BTCC in molar percent. The SHG efficiency of amino acid doped ZTS and BTCC was measured by Kurtz and Perry powder SHG test and compared with host compound. We observe enhancement in SHG efficiency each time. The grown crystals were characterized by various characterization viz. single crystal X-ray diffraction, FTIR, EDAX, UV-visible study and thermal study by TGA and DSC.

Now days the phenomenon of the frequency conversion in non linear optical materials are attracting increasing attention with increasing demand for non linear optical crystals, the growth of bulk crystals become inevitable. Many crystals of higher purity and high perfection for the electronics and optical industries are grown from aqueous solution. In the present investigation bulk single crystal of non linear optical materials Bis Glycine hydrogen bromide (BGHB) has also been grown by slow evaporation technique first time. The grown crystal was characterized by XRD, FTIR, UV-Visible study and thermal analysis, NLO test by Kurtz and Perry powder SHG test.
10.2 Suggestions for future work

In future various semi organic NLO crystals of thiourea metal complexes can be grown by adding other amino acids such as Lysine, threonine and L-cystein and their optical properties can be studied. The BTCC crystals can be grown with some other amino acids containing chiral carbon atom and SHG efficiency may be compared. The effect of solution pH on the growth, morphology and optical characteristics can be studied.

The evaporation controlled growth may be used to grow the optical quality bulk single crystal of bis glycine hydrogen bromide. The attempts can be made on the bulk growth and characterizations of some new thiourea metal complexes with enhanced SHG efficiency. Some peptide crystal may also be attempted.