

TABLE OF CONTENTS

	<i>Chapter</i>	<i>Page</i>
1.	INTRODUCTION	1
1.1.	Crystalline State	1
1.2.	Importance of Crystals	2
1.3.	Methods of Crystal Growth	6
1.3.1.	Classification	7
1.3.2.	Solid state growth methods	7
1.3.3.	Vapour growth methods	7
1.3.4.	Melt growth methods	9
1.3.5.	Solution growth methods	9
1.4.	Nonlinear Optics	10
1.4.1.	Origin of optical nonlinearity	10
1.4.2.	Nonlinear optical materials	12
1.5.	Present Investigation	14
2.	GROWTH OF SAMPLE CRYSTALS	21
2.1.	Low Temperature Solution Growth Methods	22
2.1.1.	Criteria for growth	22
2.1.2.	Metastable zone width	22
2.1.3.	Crystal-medium interface	23
2.1.4.	Impurities	23
2.1.5.	Stirring	24
2.1.6.	Growth temperature	25
2.1.7.	Solubility and supersaturation	25
2.1.8.	Choice of solvent	26
2.1.9.	Methods of crystal growth	28

2.2.	ZTS Single Crystals	32
2.2.1.	Hardness	38
2.2.2.	Optical transmission	40
2.2.3.	Thermal studies	41
2.2.4.	Laser damage studies	42
2.2.5.	Measurement of birefringence	45
2.3.	Growth of Sample Crystals	46
2.3.1.	Difficulties encountered	47
2.3.2.	Solubility	49
2.3.3.	Growth of impurity added ZTS crystals	49
2.4	HRXRD Studies	52
2.5	Results and Discussion	54
2.5.1.	General Features	54
2.5.2.	Crystalline Perfection	55
3.	CHEMICAL, STRUCTURAL AND MECHANICAL STUDIES	61
3.1.	Density Measurement	62
3.2.	FT-IR Spectral Measurements	63
3.3.	Powder XRD Measurements	64
3.4.	Estimation of Impurity Concentration	66
3.5.	Microhardness Measurements	66
3.5.1.	Mayer analysis of hardness testing	68
3.5.2.	Relation between hardness and other physical properties	69
3.6.	Results and Discussion	70
3.6.1.	FT-IR spectra	70
3.6.2.	XRD patterns	83
3.6.3.	Lattice parameters, density and impurity concentration	83
3.6.4.	Microhardness	92

4.	OPTICAL AND ELECTRICAL MEASUREMENTS	95
4.1.	The SHG Studies	97
4.2.	UV-Vis Absorption Spectral Measurements	97
4.2.1.	The UV-Vis spectroscopy	97
4.2.2.	The UV-Vis absorption measurements	99
4.3.	Photoluminescence Spectral Measurements	99
4.3.1.	The importance	99
4.3.2.	The PL measurements	100
4.4.	The AC Electrical Measurements	100
4.4.1.	The importance	100
4.4.2.	The dielectric measurements	102
4.5.	Results and Discussion	104
4.5.1.	The SHG behaviour	104
4.5.2.	The UV-Vis absorption spectra	104
4.5.3.	The PL spectra	104
4.5.4.	The dielectric parameters	109
5.	SUMMARY AND SUGGESTIONS FOR FUTURE WORK	142
5.1.	Summary and Conclusions	142
5.2.	Suggestions for Future Work	145
	REFERENCES	147
	APPENDIXES	154
A.	Resume of the Candidate	154
B.	List of Publications by the Candidate	155
C.	Indexed X-ray Diffraction Data	158