

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
1.1	Nonlinear optical effects	4
1.2	Schematic of Bridgman technique	14
1.3	Schematic of Czochralski technique	16
1.4	Schematic of experimental setup of Sankaranarayanan-Ramasamy method	22
2.1	Diffraction in crystal lattices	24
2.2	Schematic Diagram of HRXRD	26
2.3	Schematic of UV-Visible spectrophotometer	27
2.4	Schematic of Laser Damage Threshold Setup	32
2.5	Schematic of Second Harmonic set up	33
2.6	Optical Indicatrix	38
2.7	Schematic of Electro-optic modulator set up	42
2.8	Schematic of Closed Aperture Z-scan apparatus	45
2.9	Schematic of Open Aperture Z-scan apparatus	45
2.10	Schematic illustrations of energy-spreading type of optical limiters	51
2.11	Illustration of the nonlinear absorptive response of a reverse saturable absorber	53
2.12	Energy level scheme of RSA chromophore	54
2.13	Schematic of optical limiting set up	55
3.1	Reaction Scheme of IMLT	58

FIGURE NO.	TITLE	PAGE NO.
3.2	(a) As grown IMLT seed crystal, (b) Morphology of IMLT crystal	59
3.3	(a) SR method grown $\langle 0\ 1\ 0 \rangle$ IMLT crystal, (b) Cut and polished SR method grown IMLT crystals	60
3.4	Rocking curve of IMLT	62
3.5	(a) Transmittance spectrum (b) UV-Visible Absorbance spectrum of IMLT (c) Plot of photon energy versus $(\alpha h\nu)^{1/2}$ (d) Variation of refractive index with Energy (eV)	63
3.6	Indentation pattern on the (0 1 0) plane of IMLT single crystal for various loads (a) 5 g (b) 10 g (c) 25 g (d) 50 g (e) 75 g (f) 100 g (g) Variation of Vicker's Hardness number with load (h) Plot of $\log d$ with $\log P$ (i) Plot of d^2 with load (j) Variation of Yield strength with load (k) Variation of stiffness constant with load	68
3.7	(a) Variation of dielectric constant with frequency (b) Variation of dielectric loss with frequency	71
3.8	Laser damage pattern of IMLT crystal	73
3.9	Particle size dependent SHG response for IMLT in comparison with standard KDP	74
3.10	The plot between applied voltage and varying intensity (Photo detector output)	76

FIGURE NO.	TITLE	PAGE NO.
3.11	(a) Open aperture Z-scan data (b) Closed aperture Z-scan data	79
3.12	Optical limiting behavior of IMLT Single Crystal	82
4.1	Reaction Scheme of AMT	86
4.2	(a) As grown AMT seed crystal (b) Morphology of AMT crystal (c) Seeded grown AMT crystal (d) Cut and polished AMT crystals	87
4.3	HRXRD pattern of Ammonium D, L – Tartrate	90
4.4	a) Transmittance spectrum (b) UV-Visible Absorbance spectrum of AMT (c) Variation of refractive index with wavelength (d) Plot of photon energy versus $(ah\nu)^{1/2}$	92
4.5	Indentation pattern on the (0 0 1) plane of AMT single crystal for various loads (a) 5 g (b) 10 g (c) 25 g (d) 50 g (e) 75 g (f) 100 g	93
4.6	(a) Variation of Vicker's Hardness number with load (b) Plot of $\log d$ with $\log P$ (c) Plot of d^2 with load (d) Variation of Yield strength with load (e) Variation of stiffness constant with load	96
4.7	(a) Variation of dielectric constant with temperature and frequency (b) Variation of dielectric loss with temperature and frequency	99

FIGURE NO.	TITLE	PAGE NO.
4.8	Laser damage threshold pattern on AMT crystal	101
4.9	Particle size dependent SHG response for AMT in comparison with standard KDP	102
4.10	(a) Open aperture Z-scan plot (b) Closed aperture Z-scan plot	104
4.11	Optical limiting behavior of AMT single crystal	107
5.1	(a) Molecular Structure of BMZ (b) Molecular structure of PST	110
5.2	(a) As grown BMZ seed crystal (b) Morphology of BMZ crystal (c) SR method grown BMZ crystal (d) Cut and polished BMZ crystal	112
5.3	(a) As grown PST seed crystal (b) Morphology of PST crystal (c) SR method grown PST crystal (d) Cut and polished PST crystal (e) Polished wafer of PST	114
5.4	HRXRD pattern of (a) BMZ (b) PST	115
5.5	(a) Transmittance spectra of BMZ and PST (b) UV-Visible Absorbance spectra of BMZ and PST	117
5.6	(a) Variation of refractive index with wavelength of BMZ, (b) Plot of photon energy versus $(\alpha h\nu)^{1/2}$ of BMZ (c) Variation of refractive index with wavelength of PST (d) Plot of photon energy versus $(\alpha h\nu)^{1/2}$ of PST	119

FIGURE NO.	TITLE	PAGE NO.
5.7	Indentation pattern on the (012) plane of BMZ single crystal for various loads (a) 5 g (b) 10 g (c) 25 g (d) 50 g (e) 75 g (f) 100 g	121
5.8	Indentation pattern on the (001) plane of PST single crystal for various loads (a) 5 g (b) 10 g (c) 25 g (d) 50 g (e) 75 g (f) 100 g	122
5.9	(a) Variation of Vicker's Hardness number with load of BMZ (b) Plot of d^2 with load (c) Plot of $\log d$ with $\log P$ (d) Variation of Yield strength with load (e) Variation of stiffness constant with load	123
5.10	(a) Variation of Vicker's Hardness number with load of PST (b) Plot of d^2 with load (c) Plot of $\log d$ with $\log P$ (d) Variation of Yield strength with load (e) Variation of stiffness constant with load	123
5.11	(a) Variation of dielectric constant with temperature and frequency of BMZ (b) Variation of dielectric loss with temperature and frequency of BMZ (c) Variation of dielectric constant with temperature and frequency of PST (d) Variation of dielectric loss with temperature and frequency of PST	127
5.12	Laser damage pattern of (a) BMZ (b) PST	129
5.13	Particle size dependent SHG response for BMZ in comparison with standard KDP	131

FIGURE NO.	TITLE	PAGE NO.
5.14	(a) Open aperture Z-scan plot of BMZ, (b) Open aperture Z-scan plot of PST (c) Open aperture Z-scan plot of KDP, (d) Optical limiting behaviour of BMZ (e) Optical limiting behaviour of PST (f) Optical limiting behaviour of KDP	134
6.1	As grown ZnGuS seed crystal	140
6.2(a)	Morphology of ZnGuS Crystal	142
6.2(b)	Cut and polished ZnGuS crystal	142
6.3	HRXRD pattern of ZnGuS single crystal	143
6.4	(a) Transmittance spectrum (b) UV-Visible Absorbance spectrum of ZnGuS (c) Variation of refractive index with wavelength (d) Plot of photon energy versus $(\alpha h\nu)^{1/2}$	145
6.5	Indentation pattern on ZnGuS single crystal for various loads (a) 5 g (b)10 g (c)25 g (d)50 g (e)75 g (f)100 g (g) Variation of Vicker's Hardness number with load (h) Plot of $\log d$ with $\log P$ (i) Plot of d^2 with load (j) Variation of Yield strength with load (k) Variation of stiffness constant with load	148
6.6	(a) Variation of dielectric constant with temperature and frequency (b) Variation of dielectric loss with temperature and frequency	152
6.7	Optical micrograph of laser induced damage on ZnGuS crystal	154

FIGURE NO.	TITLE	PAGE NO.
6.8	Particle size dependent SHG response for ZnGuS in comparison with standard KDP	155
6.9	(a) Closed aperture Z-scan curve (b) Open aperture Z-scan curve	157
6.10	Optical limiting behavior of AMT single crystal	159
7.1	Reaction scheme of LHN	163
7.2	(a) As grown LHN seed crystals (b) Morphology of LHN crystal (c) <011> SR method grown LHN crystal (d) Cut and polished LHN crystals	164
7.3	HRXRD pattern of LHN single crystal	168
7.4	(a) Transmittance spectrum (b) UV-Visible Absorbance spectrum of LHN (c) Variation of refractive index with wavelength (d) Plot of photon energy versus $(\alpha h\nu)^{1/2}$	170
7.5	Indentation pattern on the <011> plane of LHN single crystal for various loads (a) 5 g (b) 10 g (c) 25 g (d) 50 g (e) 75 g (f) 100 g (g) Variation of Vicker's Hardness number with load (h) Plot of d^2 with load (i) Plot of $\log d$ with $\log P$ (j) Variation of Yield strength with load (k) Variation of stiffness constant with load	172
7.6	(a) Variation of dielectric constant with temperature and frequency (b) Variation of dielectric loss with temperature and frequency	176

FIGURE NO.	TITLE	PAGE NO.
7.7	Optical micrograph of laser induced damage on LHN crystal	178
7.8	Particle size dependent SHG response for LHN in comparison with standard KDP	179
7.9	(a) Closed aperture Z-scan data (b) Open aperture Z-scan data	182
7.10	Optical limiting behaviour of LHN single crystal	184
8.1	LiNbO ₃ Crystal (a)1 Mole % MgO doped (b) 4 Mole % doped (c) 5 Mole % MgO doped	188
8.2	HRXRD pattern of LiNbO ₃ Crystal (a)1 Mole % MgO doped (b) 4 Mole % doped (c) 5 Mole % MgO doped crystal	191
8.3	Transmittance spectra of LiNbO ₃ Crystal	193
8.4	UV-visible Absorbance spectrum spectrum of LiNbO ₃ Crystal	193
8.5	Optical bandgap plot (a) 1 Mole % MgO doped (b) 4 Mole % doped (c) 5 Mole % MgO doped crystal	194
8.6	Refractive Index variation with wavelength (a) 1 Mole % MgO doped (b) 4 Mole % doped (c) 5 Mole % MgO doped crystal	195
8.7	(a) Variation of Vicker's Hardness number with load (b) Plot of logd with logP (c) Plot of d ² with load (d) Variation of Yield strength with load (e) Variation of stiffness constant with load	197

FIGURE NO.	TITLE	PAGE NO.
8.8	(a) Variation of Vicker's Hardness number with load (b) Plot of $\log d$ with $\log P$ (c) Plot of d^2 with load (d) Variation of Yield strength with load (e) Variation of stiffness constant with load	198
8.9	(a) Variation of Vicker's Hardness number with load (b) Plot of $\log d$ with $\log P$ (c) Plot of d^2 with load (d) Variation of Yield strength with load (e) Variation of stiffness constant with load	199
8.10	(a) Variation of dielectric constant with temperature and frequency for 1 Mole % MgO doped (b) Variation of dielectric loss with temperature and frequency 1 Mole % MgO doped	202
8.11	(a) Variation of dielectric constant with temperature and frequency of 4 Mole % MgO doped (b) Variation of dielectric loss with temperature and frequency of 4 Mole % MgO doped	203
8.12	(a) Variation of dielectric constant with temperature and frequency of 5 Mole % MgO doped (b) Variation of dielectric loss with temperature and frequency of 5 Mole % MgO doped	204
8.13	Optical micrograph of laser induced damage LiNbO ₃ Crystal (a) 1 Mole % MgO doped (b) 4 Mole % doped (c) 5 Mole % MgO doped crystal	206

FIGURE NO.	TITLE	PAGE NO.
8.14	Closed aperture Z-scan data (a) 1 Mole % MgO doped (b) 4 Mole % doped (c) 5 Mole % MgO doped crystal	208
8.15	Open aperture Z-scan data (a) 1 Mole % MgO doped (b) 4 Mole % doped (c) 5 Mole % MgO doped crystal	209
8.16	Optical limiting behavior of LiNbO ₃ Crystal (a) 1 Mole % MgO doped (b) 4 Mole % doped (c) 5 Mole % MgO doped	212