## INDEX

CONTENTS	I-V
LIST OF FIGURES	VI-IX
LIST OF TABLES	X-XII
LIST OF ABBREVIATIONS	XIII

## CONTENTS

Titles	/Subtitl	28		Page No.
CHA	PTER 1	INTRODUCTION		01-27
1.1	Introduction			01
1.2	synthet	ic Quartz		01
1.3	Lumine	escence		03
1.4	Therma	lly stimulated luminesc	ence (TSL)	04
1.5	Optical	ly stimulated luminesce	nce (OSL)	07
1.6	Models of OSL			09
	1.6.1	Simplest Model: one t	rap/one center	09
	1.6.2	Competing, deep trap		10
	1.6.3	Competing shallow tra	p	12
	1.6.4	Competing recombina	tion center	13
1.7	TL of s	ynthetic quartz and its I	iterature survey	13
1.8	OSL of synthetic quartz and its Literature survey			16
1.9	Aim and Objective			18
1.10	Referen	ices		23
CHA	PTER 2	: MATERIAL AS SYN	THETIC QUARTZ	28-35
2.1	Introdu	ction		28
2.2	Structure of Natural and synthetic Quartz			28
2.3	Defects in Quartz and synthetic quartz		31	
	2.3.1	Intrinsic defects		31
		2.3.1.1 Oxygen vac	ancy centers	31
		2.3.1.2 Silicon vaca	ancy centers	32

	2.3.2	Extrinsio	e defects		32
		2.3.2.1	Substitutio	onal defect centers	32
			2.3.2.1.1	Al centres	32
			2.3.2.1.2	Fe centres	33
			2.3.2.1.3	Ge centres	33
			2.3.2.1.4	Ti centres	33
			2.3.2.1.5	P centres	33
		2.3.2.2	Interstitial	defect centers	33
			2.3.2.2.1	Alkali ions	33
			2.3.2.2.2	Hydrogen ions	34
2.4	Referen	nces			34
СНА	PTER 3	: EXPER	IMENTAL	METHODS	36-47
3.1	Materia	ıl			36
3.2	Instrum	ients			36
3.3	Prepara	tion of na	no sized syn	thetic quartz (NSQ) sample	37
	3.3.1	High end	ergy Planeta	ry Ball Mill Technique	37
	3.3.2	Prelimin	ary optimiza	ation of the parameters for	38
		sample p	preparation		
	3.3.3	Thermal	Annealing	Treatment	39
	3.3.4	Irradiati	on Treatmen	t	39
3.4	Charact	terization	of Nano size	ed Sample	40
	3.4.1	Particle	Size Analys	is	40
	3.4.2	Scanning	g Electron M	ficroscopy (SEM) Analysis	40
	3.4.3	Transmi	ssion electro	on Microscopy (TEM)	40
	3.4.4	X-Ray I	Diffraction (2	XRD) Analysis	41
	3.4.5	Energy l	Dispersive X	C-ray spectroscopy(EDS/EDX)	42
	3.4.6	Fourier '	Transfer Infi	rared Spectroscopy (FTIR)	42
	3.4.7	UV-Visi	ble spectros	copy study	42
	3.4.8	Photolur	ninescence s	study	43
	3.4.9	Thermol	uminescenc	e Analysis	43
	3.4.10	Opticall	y Stimulated	Luminescence Analysis	44

	3.4.11	Electron Spin Resonance (ESR) Analysis	45
3.5	Referen	nces	46
CHA	PTER 4	: CHARACTERIZATION OF NANO-SIZED	48-66
SYN	THETIC	CQUARTZ	
4.1	Introdu	ction	48
4.2	Nano-s	ized synthetic quartz sample preparation	48
	4.2.1	Preliminary optimization of the parameters for	49
		sample preparation	
		4.2.1.1 Variation in Milling Ball Diameters	49
		4.2.1.2 Use of Different Dispersing Mediums	50
		4.2.1.3 Variation in Surfactant Concentration	50
		4.2.1.4 Variation in Ball to Powder Weight	51
		4.2.1.5 Variation in Milling Time	52
	4.2.2	Preparation of optimized nano synthetic quartz	52
	4.2.3	Thermal and irradiation treatment	53
4.3	Charac	terization of nano sized synthetic quartz sample	53
	4.3.1	Particle Size Analysis	53
	4.3.2	Scanning Electron Microscopy (SEM) Study	54
	4.3.3	Transmission electron Microscopy (TEM) study	55
	4.3.4	X-Ray Diffraction (XRD) study	56
	4.3.5	Electron Diffraction X-ray spectroscopy	59
	4.3.6	Fourier Transfer Infrared Spectroscopy (FTIR)	60
	4.3.7	UV-Visible spectroscopy study	61
	4.3.8	Photoluminescence Analysis	63
4.4	Referen	nces	64
CHA	PTER 5	: LUMINESCENCE STUDY OF NANO-SIZED	67-131
SYN	THETIC	CQUARTZ	
5.1	Introdu	ction	67
5.2	Thermo	bluminescence (TL) study of prepared NSQ samples	67
	5.2.1	Effect of beta dose on TL of un-annealed NSQ	68
		samples	

	5.2.2	Effect of beta dose on TL of annealed NSQ samples	71
	5.2.3	Comparative TL study between unannealed and annealed NSQ samples for beta doses	75
	5.2.4	Effect of optical bleaching temperatures on TL of unannealed and annealed NSQ specimens	77
	5.2.5	Comparative TL study between unannealed and annealed NSQ samples followed by beta doses and optical bleaching temperatures	86
	5.2.6	TL-Dose Response Curve (DRC) study of NSQ samples	90
		5.2.6.1 TL-DRC study of unannealed NSQ samples	91
		5.2.6.2 TL-DRC study of annealed NSQ samples	91
		5.2.6.3 TL-DRC study of annealed NSQ samples followed by optical bleaching temperatures	92
5.3	OSL st	udy of NSQ samples at room temperature	93
	5.3.1	Effect of beta doses on OSL decay recorded at room temperature (RT) for unannealed NSQ samples	94
	5.3.2	Effect of beta dose on OSL of annealed NSQ samples	97
5.4	Compa	rative OSL at RT study of NSQ samples	101
	5.4.1	Comparative study of OSL recorded at RT between unannealed and annealed NSQ samples for beta doses	101
5.5	Deconv	volution study of OSL at RT for NSQ samples	102
	5.5.1	Deconvolution study of unannealed NSQ samples of OSL at RT under the influence of beta doses	103

5.5.2 Deconvolution study of annealed NSQ samples of	107
OSL at RT under the influence of beta doses	
5.6 OSL at RT-DRC study for NSQ samples	112
5.6.1 OSL at RT-DRC study of unannealed NSQ	112
samples	
5.6.2 OSL at RT-DRC study of annealed NSQ samples	112
5.7 OSL study of NSQ samples at elevated temperature (160°C	113
ET)	
5.7.1 Effect of beta doses on OSL decay recorded at	114
elevated temperature (ET) at 160°C for	
unannealed NSQ samples	
5.7.2 Effect of beta dose on OSL study at 160°C ET for	116
annealed NSQ samples	
5.8 Deconvolution study of OSL at ET for NSQ samples	120
5.8.1 Deconvolution study of unannealed NSQ samples	120
of OSL at ET under the influence of beta doses	
5.8.2 Deconvolution study of annealed NSQ samples of	121
OSL at ET under the influence of beta doses	
5.9 OSL at ET-DRC study of NSQ samples	122
5.9.2 OSL at ET-DRC study of unannealed NSQ	123
samples	
5.10 Comparative study of deconvolution of OSL at RT and	123
OSL at ET of NSQ samples	
5.11 Electron Spin Resonance Analysis	125
5.12 Reference	130
<b>CHAPTER 6: SUMMARY AND CONCLUSIONS</b>	
Appendix I	138-139