

CONTENTS

List of Figures	I
List of Tables	IV
List of Publications	V

Chapter 1 Introduction

1.1 Fundamentals of nanomaterials	2
1. 2 Different applications of nanomaterials	8
1.3 Nanostructured semiconducting oxides	9
1.3.1 TiO ₂ nanostructures	10
1.3.2 SnO ₂ nanostructures	12
1.4 Outline of the thesis	17
References	19

Chapter 2 Formulation of theoretical methods

2.1 Introduction	24
2.2 Different thermodynamic models for nanostructures	25
2.2.1 Melting point and Glass transition temperature	29
2.2.2 Diffusion co-efficient	32
2.2.3 Surface energy and Tolman length	33
2.2.4 Catalytic activation energy	35
References	38

Chapter 3 Experimental methods and characterization techniques

3.1 Synthesis methods for nanoparticles	42
3.1.1 Co-precipitation method	45
3.1.2 Sol-gel synthesis	46

3.1.3 Powder Metallurgy method	48
3.2 Characterization techniques	51
3.2.1 Powder X-Ray diffraction (XRD)	51
3.2.2 Scanning electron microscopy (SEM)	54
3.2.3 Energy dispersive spectroscopy (EDS)	56
3.2.4 Differential Scanning Calorimetry (DSC)	57
3.2.5 Micro Hardness Measurement	59
References	60

Chapter 4 Size dependent properties of SnO₂ and TiO₂ nanostructures

4.1 Thermodynamic properties in SnO ₂ nanoparticles	63
4.1.1 Melting temperature	63
4.1.2 Glass-transition temperature	66
4.1.3 Kauzmann temperature	68
4.2 Diffusion co-efficient in SnO ₂ nanoparticles	69
4.3 Surface properties in SnO ₂ and TiO ₂ nanoparticles	71
4.4 Catalytic activation energy in SnO ₂ , TiO ₂ and CeO ₂ nanoparticles	79
References	84

Chapter 5 Synthesis and characterizations of pristine and doped SnO₂ and TiO₂ nanoparticles

5.1 Titanium dioxide (TiO ₂) nanoparticles	91
5.1.1. Synthesis	91
5.1.2. XRD Results	91
5.2 Tin dioxide (SnO ₂) nanoparticles	93
5.2.1. Synthesis	93

5.2.2. XRD Results	94
5.2.3 Differential Scanning Calorimetry (DSC) study	99
5.2.4 Scanning Electron Microscopy (SEM)	101
5.3 Iron (Fe) doped Tin dioxide (SnO ₂) nanoparticles	101
5.3.1 Synthesis	102
5.3.2 Characterizations	102
5.4 Ag-SnO ₂ nanocomposites	104
5.4.1 Process	104
5.4.2 Characterizations	105
5.4.2.1 XRD analysis	105
5.4.2.2 Density results	108
5.4.2.3 Micro-hardness measurement	109
References	110

Chapter 6 Conclusions and suggestions for future work

Summary	112
Future direction based on present thesis work	117

Reprints of published papers

Curriculum Vitae