

Table of contents

Abbreviations.....	
Symbols.....	
Preface.....	
1. Chapter 1	1
1.1 “Allotropic” and “Polymorphic” transformation.....	1
1.2 Quasi-chemical theory for the formation of solid solution or intermetallic	10
1.3 Miedema’s Model	11
1.4 Intermetallics.....	12
1.4.1 Stoichiometric intermetallic compounds	12
1.4.2 Non-stoichiometric intermetallic compounds.....	13
1.4.3 Electron compounds / Hume-Rothery compounds.....	13
1.4.4 Frank-Kasper phases / Size factor compounds.....	14
1.4.4.1 A-15 compounds.....	14
1.4.4.2 Laves Phase.....	14
1.4.4.3 σ , μ , M, P, and R phases	14
1.4.5 Heusler Alloys.....	15
1.5 High-entropy alloys.....	16
1.6 Alloy Design Strategies.....	20
1.6.1 Strength-Ductility Trade off Dilemma	21
1.6.2 Inverse Hall-Petch Relationship.....	22
1.6.3 Structure-Property Correlations	23
1.6.4 Grain Boundary Engineering.....	24
1.7 High-energy Ball Milling	25
1.7.1 Extension of solid solubility.....	25
1.7.2 Refinement of grain size to nanoscale range.....	26
1.7.3 Formation of intermetallic, metastable phases and quasicrystal.....	26
1.8 Motivation and Objectives	28
2. Chapter 2.....	29
2.1 Materials and alloy synthesis.....	29
2.1.1 Vacuum Induction Melting.....	30
2.1.2 Differential Scanning Calorimetry.....	30
2.1.2 High energy ball milling.....	31
2.2 Crystal Structure and microstructural characterization.....	32
2.2.1 X-ray diffraction.....	32
2.2.2 Scanning electron microscopy.....	32
2.2.3 Transmission electron microscopy.....	33

3.	Chapter 3.....	35
	3.1 Introduction.....	35
	3.2 Experimental Techniques.....	36
	3.3 Results	37
	3.4 Discussion.....	40
	3.5 Conclusions.....	48
4.	Chapter 4.....	49
	4.1 Introduction.....	49
	4.2 Experimental Techniques.....	50
	4.3 Results.....	52
	4.4 Discussion.....	61
	4.4.1 Phase formation and stability.....	61
	4.4.2 Microstructural evolution.....	66
	4.4.3 Structure and defects in NiMnSb and NiMnSbV.....	67
	4.5 Conclusions.....	69
5	Chapter 5.....	71
	5.1 Introduction.....	71
	5.2 Experimental Techniques.....	73
	5.3 Results.....	74
	5.4 Discussion.....	82
	5.4.1 Processing route dependence of phase evolution.....	82
	5.4.2 Effect of configurational entropy.....	84
	5.4.3 Role of atomic size and enthalpy of mixing.....	85
	5.5 Conclusions.....	86
6	Chapter 6	89
	6.1 Conclusions.....	89
	6.2 Suggestions for future work.....	90
	References	93-113

List of Publications

List of Conference Presentations