

TABLE OF CONTENTS

TITLE PAGE	i
APPROVAL PAGE	ii
HALAMAN PENGESAHAN	iii
PRONOUNCEMENT	iv
PREFACE	v
ACKNOWLEDGEMENTS	vi
TABLE OF CONTENTS	vii
LIST OF FIGURES	x
LIST OF TABLES	xiii
LIST OF ABBREVIATIONS AND ACRONYMS	xiv
NOMENCLATURE	xv
ABSTRACT	xvii
INTISARI	xviii
CHAPTER I INTROUDUCTION	1
1.1. Background	1
1.2. The Problem Formulation	4
1.3. The Limitation of Problems	4
1.4. Objectives of Research	4
1.5. Benefits of Research	5
CHAPTER II LITERATURE REVIEW	6
CHAPTER III THEORETICAL BACKGROUND	10
3.1. Nature of Aluminum Alloys	10
3.1.1. Cast Aluminum Alloys	12
3.1.2. Wrought Aluminum Alloys	13

3.2. Aluminum-Magnesium alloy (Al-Mg)	15
3.3. Rolling Process	17
3.3.1. Hot Rolling	19
3.3.2. Cold Rolling	22
3.4. Heat Treatment	24
3.4.1. Preheating and Homogenization	24
3.4.2. Annealing Treatment	25
3.4.3. Solution Heat Treatment	29
3.5. X-Ray Diffraction	30
3.6. Mechanical Testing for Metalworking Processes	31
3.6.1. Hardness Test	32
3.6.2. Tensile Test	35
3.6.3. Fatigue Test	37
CHAPTER IV RESEARCH METHODOLOGY	43
4.1. Materials	43
4.2. Experimental Procedures	43
4.2.1. Homogenization Treatment	43
4.2.2. Cold Rolling Procedures	43
4.2.3. Annealing Procedures	44
4.3. Microstructure Characterization	45
4.3.1. Optical Microscope	45
4.3.2. Scanning Electron Microscope	45
4.3.3. X-ray diffraction	46
4.4. Mechanical Testing	47
4.4.1. Tensile Test	47

4.4.2. Hardness Test	48
4.4.3. Fatigue crack propagation test	49
4.5. Flowchart of Experiment	51
CHAPTER V RESULTS AND DISCUSSION	53
5.1. Microstructure	53
5.1.1. Microscopical Examination	53
5.1.2. X-Ray Diffraction (XRD) Analysis	61
5.2. Hardness and Tensile Properties	63
5.2.1. Effect of Cold Rolling on Hardness	63
5.2.2. Effect of Annealing Time on Hardness	65
5.2.3. Effect of Cold rolling on Tensile Properties	68
5.2.4. Evolution of Tensile Properties During Annealing Time	70
5.3. Fatigue Crack Propagation Rate	73
5.3.1. Effect of Cold Rolling on Fatigue Crack Propagation Rate	73
5.3.2. Effect of Annealing Time on Fatigue Crack Propagation Rate	78
5.4. Fatigue Fractography Analysis	82
CHAPTER VI CONCLUSIONS AND RECOMMENDATIONS	88
6.1. Conclusions	88
6.2. Recommendations	89
REFERENCES	90
APPENDIXES	96