

CONTENT

ACKNOWLEDGEMENT	i
ABSTRACT	ii
CONTENT	iv
LIST OF TABLE	ix
LIST OF FIGURE	xi
LIST OF SCHEME	xiv
LIST OF SYMBOL AND ABBREVIATION	xv

CHAPTER ONE

Introduction

1.1	TRINUCLEAR OXO-CENTRED COMPLEX	1
1.1.1	Trichromium oxo-centred complex	3
1.1.2	Triiron oxo-centred complex	4
1.2	CHROMIUM-BASED CATALYSTS FOR POLYMERIZATION OF OLEFINS	4
1.3	ZIEGLER-NATTA POLYMERIZATION	6
1.4	MECHANISMS OF ZIEGLER-NATTA POLYMERIZATION	7
1.4.1	Monometallic mechanism	8
1.4.2	Bimetallic mechanism	10
1.4.3	The trigger mechanism	11
1.5	KINETICS OF ZIEGLER-NATTA POLYMERIZATION	12
1.6	POLYOLEFINS	16
1.6.1	Polyethylene (PE)	18
1.7	SCOPE OF STUDY	21
	References	23

CHAPTER TWO

Synthesis and Characterization of Catalysts

2.1	PREPARATION OF CATALYST	27
2.1.1	Synthesis of chromium(III) acetate, CI[1]	28
2.1.2	Synthesis of mixed-metal (Cr-Fe) acetate, CI[2] and CI[3]	29
2.1.3	Synthesis of iron(III) acetate, CI[4]	29
2.1.4	Synthesis of chromium(III) benzoate, CI[5]	29
2.2	CHARACTERIZATION OF COMPLEXES	30
2.2.1	Solubility test	30
2.2.2	IR spectroscopy	30
2.2.3	UV-visible spectroscopy	31
2.2.4	Metal content analysis	31
2.2.5	CHN-elemental Analysis	31
2.2.6	Thermal gravimetric analysis (TGA)	32
2.2.7	X-ray Crystallography	32
2.3	RESULTS AND DISCUSSION	33
2.3.1	Physical properties	33
2.3.2	UV-visible	35
2.3.3	IR spectroscopy	39
2.3.4	Elemental analysis	44
2.3.5	Thermal gravimetric analysis (TGA)	45
2.3.6	X-Ray crystallography	48
	<i>a) CI[1]: [Cr₃-O(C₂H₃O₂)₆(H₂O)₃]NO₃.CH₃CO₂H</i>	51
	<i>b) CI[4]: [Fe₃-O(C₂H₃O₂)₆(H₂O)₃]NO₃.CH₃CO₂H</i>	51
2.3.7	Structure of complexes	52
	References	55

CHAPTER THREE

Polymerization of Ethylene Using Chromium(III) and Chromium(III)-Iron(III) Mixed-metal Acetate As Catalysts

3.1	INTRODUCTION	58
3.1.1	Percentage of crystallinity	59
3.1.2	Kinetic study	59
3.2	EXPERIMENTAL	61
3.2.1	Experimental setup	61
3.2.2	Constant volume setup	63
3.2.3	Polymerization of ethylene	65
3.2.4	Characterization of polymer	69
	<i>a) IR spectroscopy</i>	69
	<i>b) Thermal gravimetric analysis (TGA)</i>	69
	<i>c) Differential scanning calorimetric (DSC)</i>	69
3.3	RESULTS AND DISCUSSION	70
3.3.1	Polymerization of ethylene	71
3.3.2	Effect of varying Al/Cr molar ratio	75
3.3.3	Effect of mixed-metal complexes	79
3.3.4	Effect of substituent group in catalysts	82
3.3.5	Effect of variation temperature	84
3.3.6	Kinetic of polymerization	86
3.3.7	Characterization of polymer	87
	<i>a) IR spectroscopy</i>	87
	<i>b) Thermal gravimetric analysis (TGA)</i>	90
	<i>c) Differential scanning calorimetric (DSC)</i>	91
	References	96

CHAPTER FOUR

Polymerization of Ethylene-SMRCV Using CI[1]

4.1	INTRODUCTION	100
4.1.1	Natural rubber	100
4.1.2	Standard Malaysia rubber	101
4.1.3	Grafting of natural rubber	102
4.2	EXPERIMENTAL	103
4.2.1	Preparation of SMRCV-toluene solution	103
4.2.2	Polymerization of Ethylene-SMRCV	103
4.2.3	Characterization of polymer	104
	<i>a) IR spectroscopy</i>	104
	<i>b) Thermal gravimetric analysis (TGA)</i>	105
	<i>c) Powder X-ray Diffraction (XRD) analysis</i>	105
4.3	RESULTS AND DISCUSSION	105
4.3.1	Polymerization of ethylene-SMRCV	105
4.3.2	Effect of addition of SMRCV	109
4.3.3	Characterization of polymer	112
	<i>a) IR spectroscopy</i>	112
	<i>b) Thermal gravimetric analysis (TGA)</i>	115
	<i>c) Powder X-ray Diffraction (XRD) analysis</i>	117
	References	120

CHAPTER FIVE

Conclusion

5.1	CONCLUSION	123
5.2	SUGGESTIONS FOR FUTURE STUDY	124
	APPENDIX	126