

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	The Aim of the Work and Its Challenges	2
1.2	The Procedures of the Work	3
<b>2</b>	<b>Literature Review</b>	<b>4</b>
2.1	Linear Low-Density Polyethylene (LLDPE)	4
2.2	LLDPE Stretch Wrapping Film	5
2.2.1	Blown Film Process	6
2.2.2	Cast Film Process	7
2.3	Performance Formula of Stretch Film	9
2.4	Review of Properties of Films Produced in Different Conditions	10
<b>3</b>	<b>Material and Experimental Setup</b>	<b>21</b>
3.1	Material	21
3.2	Film Manufacturing Setup	22
3.3	Rheology Test	25
3.3.1	High-Pressure Capillary Rheometer	25
3.3.2	Plate-Plate Rheometer	25
3.4	Mechanical Test	25
3.4.1	Highlighter Test	26
3.4.2	Tensile Test	27
3.4.3	Impact Tensile Tests	27
3.5	Optical Test	27
3.5.1	Reflection	27
3.5.2	Transmission	28
3.6	Morphology	28
3.6.1	Scanning Electron Microscope (SEM)	28
3.6.2	Atomic Force Microscopy (AFM)	29
3.7	Crystallinity	30

3.7.1	Differential Scanning Calorimetry (DSC) .....	30
3.7.2	1D X-ray Diffraction .....	31
3.8	Orientation .....	31
3.8.1	Shrinkage Test.....	31
3.8.2	2D Wide Angle X-ray Scattering (WAXD).....	31
3.8.3	Polarized Fourier Transform Infrared Spectroscopy (FTIR).....	32
3.9	Study on Molecular Degradation .....	32
3.9.1	Melt Flow Index (MFI) .....	32
3.9.2	High-Temperature Gel Permeation Chromatography (HT-GPC) .....	33
<b>4</b>	<b>Preliminary Examinations and Results .....</b>	<b>34</b>
4.1	Evaluation of the Sharkskin during the Film Process.....	35
4.2	Evaluation and Prediction of Gross Melt Fracture during the Film Process .....	39
<b>5</b>	<b>Main Examinations and Results .....</b>	<b>45</b>
5.1	Film Process Conditions .....	45
5.1.1	Speed Parameter in the Film Manufacturing .....	47
5.1.2	Air-gap Parameter in the Film Manufacturing .....	49
5.1.3	Frost-line Parameter in the Film Manufacturing .....	50
5.1.4	Film Thickness Parameter in the Film Manufacturing .....	50
5.2	Mechanical Properties .....	51
5.2.1	Highlighter Test.....	51
5.2.2	Tensile Tests and Impact Tensile Tests .....	57
5.3	Optical Properties .....	60
5.3.1	Transmission Test .....	61
5.3.2	Reflection Test.....	62
5.4	Surface Morphology .....	63
5.4.1	Scanning Electron Microscope (SEM) .....	63
5.4.2	Atomic Force Microscopy (AFM).....	69
5.5	Study on Crystallinity .....	79

5.5.1	Differential Scanning Calorimetry (DSC).....	79
5.5.2	Wide-Angle X-Ray Scattering.....	82
5.6	Calculation of Polymer Chain Orientation .....	87
5.6.1	2D Wide Angle X-ray Scattering (WAXS).....	87
5.6.2	Shrinkage Test.....	89
5.6.3	Polarized Fourier Transform Infrared Spectroscopy (FTIR) .....	91
5.7	Evaluating Degradations of the Polymer Chains.....	96
5.7.1	Evaluating Molecular Degradation by Melt Flow Index (MFI) .....	96
5.7.2	Evaluating Molecular Degradation by Gel Permeation Chromatography (GPC) .....	97
<b>6</b>	<b>Conclusions and Prospects .....</b>	<b>99</b>
<b>7</b>	<b>Environmental Conservation.....</b>	<b>102</b>
7.1	Oxo-Biodegradable Plastics Are Safe or Harmful? .....	104
7.2	Poly Hydroxy Alkanoates (PHA) .....	105
7.3	Polylactic Acid (PLA) and Investigation on PLA Film .....	106
7.3.1	Materials .....	108
7.3.2	Compositions of PLA/PMMA Blends and Study on their Rheology .....	108
7.3.3	Film Stretching Conditions and Study on the Properties of the Films .....	114
7.4	Conclusions and Prospect of PLA Blend .....	120
	<b>References .....</b>	<b>122</b>
	<b>Appendix .....</b>	<b>132</b>
	<b>Nomenclature.....</b>	<b>I</b>
	<b>Publications and Presentations .....</b>	<b>IV</b>
	<b>Lebenslauf.....</b>	<b>V</b>