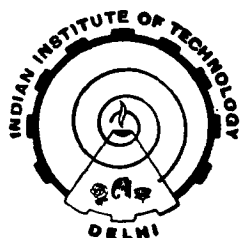


**STUDIES ON BLENDS OF
POLY (ETHYLENE TEREPHTHALATE) AND
POLY (BUTYLENE TEREPHTHALATE)**

by
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DEPARTMENT OF TEXTILE TECHNOLOGY

submitted
in fulfilment of the requirements
of the degree of
DOCTOR OF PHILOSOPHY




to the
INDIAN INSTITUTE OF TECHNOLOGY, DELHI
January, 1987

CERTIFICATE

This is to certify that the thesis entitled "Studies on Blends of Poly(ethylene terephthalate) and Poly(butylene terephthalate)", being submitted by Mr. Siba Prasad Mishra to the Indian Institute of Technology, Delhi for the award of the degree of Doctor of Philosophy in Textile Technology, is a record of bonafide research work carried out by him. Mr. Siba Prasad Mishra has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis, which to my knowledge has reached the requisite standard.

The results contained in this thesis have not been submitted, in part or full, to any other University or Institute for the award of any degree or diploma.


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Dedicated
to
my late father
and mother

A C K N O W L E D G E M E N T

I wish to express my sincerest gratitude and indebtedness to my supervisor, Dr. B.L. Deopura, Assistant Professor, Department of Textile Technology, Indian Institute of Technology, Delhi for his guidance, encouragement and taking keen interest throughout the duration of this work.

My thanks are due to Prof. M.L. Gulrajni, Head, Department of Textile Technology, for extending all necessary facilities during the research work.

I am also thankful to Dr. A. Mishra, Centre of Material Science, and Dr. R.B. Chavan, Department of Textile Technology for their valuable suggestions at various stages of this project.

I am grateful to :

All the staff members of Testing, Fibre Science, & Textile Chemistry Laboratories for their co-operation;

ITMMEC for DSC work ;

My friends S. Sanyal, Dr. R. Chattopadhyay, A. Mukherjee, D. Dhara, A.G. Goswami, M. Kaur, K.N. Bhowmick, K.B. Krishnakumar and all others for their help and encouragement ;

And above all to my wife, Shilpi.

(SIBA PRASAD MISHRA)

A B S T R A C T

The blends of poly(ethylene terephthalate) (PET) and poly(butylene terephthalate) (PBT) are investigated in unoriented and in oriented fibre form. Different thermodynamic concepts i.e., (i) heat of mixing, (ii) free energy of mixing and (iii) interaction parameter, are used to understand the compatibility of the components in the blend. PET/PBT system is compatible in a wide range of composition due to a small difference in solubility parameter, and a closer degree of polymerisation (DP) in terms of reference volume. The spinodal diagram is a UCST system with an unstable range between 80/20 to 20/80 of PET/PBT weight fractions.

Addition of upto 4% PBT in PET produces an increase in viscosity and decrease in activation energy due to higher chain entanglement density. Addition of 6% PBT initiated phase segregation and further increases the crystallization rate due to higher nucleation density formed by phase segregation.

The isothermal crystallization behaviour of PET on the blend (100/0 to 90/10) is governed by the mobility of PBT. When the mobility is high i.e., $T_{ic} > 200^{\circ}\text{C}$

larger PET crystals grow. On the other hand, when the mobility of PET is low i.e., $T_{ic} < 200^{\circ}\text{C}$, it restricts the crystallization of PET.

The melting points of the blend components in the fibre are lower than that of parent polymer due to differences in crystal sizes and defects and indicate negligible transesterification. A phase segregation is observed in the range of 90/10 to 20/80 in DTA thermogram and 85/15 to 10/90 in x-ray photograph. The average crystalline orientation function is nearly same for all the sample. The amorphous orientation function does not change in the unstable range of composition and shows two distinct minima at 92/8 and 2/98 PET/PBT blends. 98/2 PET/PBT blend fibre shows high strength and high modulus due to high intercrystalline links. 90/10 blend fibre have high modulus and comparatively high strength.

All the blended fibre, in particular 92/8 and 60/40 PET/PBT, have higher dye uptake values than that of PET fibre.

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C O N T E N T S

	<u>Page</u>
ABSTRACT	
CHAPTER - 1 INTRODUCTION	1
CHAPTER - 2 LITERATURE REVIEW	5
2.1 Poly(ethylene terephthalate) (PET)	5
2.2 Poly(butylene terephthalate) (PBT)	8
2.3 Polyblend	10
2.4 Rheology of Polymer Blend	14
2.4.1 Macro-rheological level	16
2.4.2 Micro-rheological level	17
2.4.2.1 Log-additivity rule	18
2.4.2.2 Hashin's additivity rule	18
2.4.2.3 Heitmiller's inverse additivity rule	19
2.4.2.4 Sheath-core rule	20
2.5 Morphology of Polymer Blend	20
2.6 Mechanical Properties	26
2.7 Dyeing Properties	30
CHAPTER - 3 THEORETICAL PREDICTIONS OF PHASE BEHAVIOUR	33
3.1 Theoretical Aspect	33
3.2 Heat of Mixing	36
3.3 Free Energy of Mixing and Interaction Parameter	39

	<u>Page</u>
CHAPTER - 4 EXPERIMENTAL METHODS	44
4.1 Material Characteristics	44
4.2 Melt-blending	44
4.3 Rheological Experiment	48
4.3.1 Bagley's Correction	48
4.3.2 Rabinowitch-Mooney correction	50
4.3.3 Temperature dependence of Viscosity	51
4.4 Crystallization and Melting Experiment	52
4.5 Blend Fibre Preparation	54
4.6 Density Experiment	56
4.7 Mechanical Properties	58
4.7.1 Stress-strain behaviour on Instron	58
4.7.2 Sonic Modulus using Dynamic Pulse Propagation Meter	59
4.8 Thermal Study	59
4.9 X-ray Diffraction Studies	60
4.9.1 Crystallinity Study	60
4.9.2 Orientation Study	60
4.10 Birefringence	61
4.11 Shrinkage Studies	62
4.12 Dyeing Studies	62

	<u>Page</u>
CHAPTER - 5	64
BEHAVIOUR OF BLEND POLYMERS	
5.1 Rheological Behaviour	64
5.2 Depression in Melting Temperature	64
5.3 Analysis of Melting Thermograms	72
5.4 Non-isothermal Crystallization	73
CHAPTER - 6	77
PROPERTIES OF BLEND FIBRES	
6.1 Thermal Analysis	77
6.2 X-ray and Density Analysis	78
6.3 Stress-strain Analysis	83
6.4 Analysis of Strength and Modulus by Models	85
6.5 Dyeing Behaviour	88
6.5.1 Equilibrium Dye Uptake	88
6.5.2 Diffusion Co-efficient	90
6.6 Phase Segregation Behaviour	92
CHAPTER - 7	95
CONCLUSIONS AND SUGGESTIONS	
7.1 Conclusions	95
7.1.1 Theoretical Predictions	95
7.1.2 Unoriented Blend Studies	96
7.1.3 Oriented Blend Studies	97
7.2 Further Suggestions	98
APPENDIX - A	
PREDICTION OF VISCOSITY OF BLENDS OF NYLON-6 WITH DIFFERENT MOLECULAR COMPONENTS	100
REFERENCES	102
PUBLICATIONS	119