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

by

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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

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ABSTRACT

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 seggregation and further increases the crystallization rate due to higher nucleation density formed by phase seggregation.

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., $T_{ic} > 200^{\circ}C$

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