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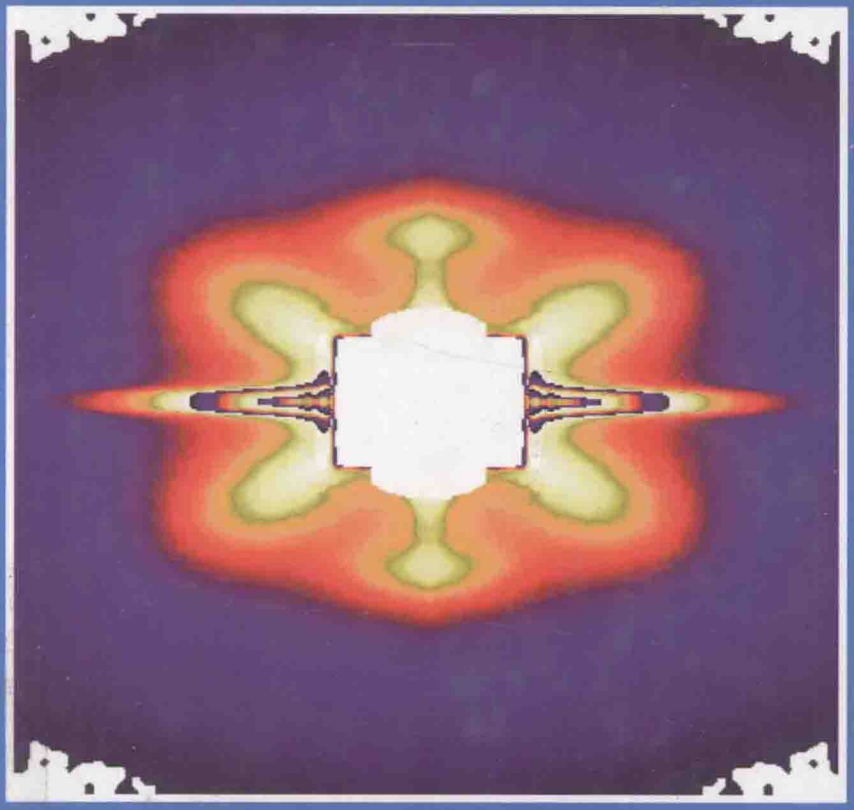
Handbook of Thermoplastic Polyesters

Edited by Stoyko Fakirov

Volume 2



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Homopolymers, Copolymers, Blends, and Composites

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Cover photo: SAXS pattern from a drawn PET/PE blend taken at DESY-Hamburg (for more details see chapter 23).

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Preface

The polyesters do not by any means constitute the largest group among commercial synthetic polymers. Nevertheless, with respect to their range of application, they enjoy a leading position. First introduced as a material for synthetic fibers (Trevira) in 1953, poly(ethylene terephthalate) (PET) has found new, interesting and enduring applications, in many cases without any alternative. It seems worth recalling that in their classical application, the textile industry, PET fibers could be of the cotton, wool, or silk type and, what is more, this can be effected without any chemical modification. While PET has rather limited use as an engineering plastic, PET films (Mylar, Hostafan), because of their excellent electrical properties, still find wide application in the electronics and electrical industries. The application of PET for packaging purposes, especially for carbonated soft drinks, is still a monopoly. Nowadays, this is the main reason for its annual production growth of 10%.

All of these opportunities for PET application are related to its peculiar properties, originating mostly from its structural characteristics. Of prime importance is its low crystallization rate, allowing the material to be easily obtained in the glassy state (photographic films, bottles). Secondly, PET is chemically very stable and practically insoluble, which makes it very attractive as a packaging material. At the same time, because of the presence of functional groups, PET easily undergoes chemical interactions (additional condensation, transreactions) in blends with other condensation polymers or functionalized polyolefins, provided the temperature is high enough (preferably, in the melt). This helps one to overcome compatibilization problems, as well as to upgrade the molecular weight of PET *via* solid state postcondensation.

Since poly(butylene terephthalate) (PBT) differs only slightly from PET in chemical composition, and more substantially in its properties (*e.g.*, much higher crystallization rate, lower melting point, *etc.*), its application is relatively limited. PBT is a desired partner for copolymers (*e.g.*, with

thermoplastic elastomers), for blends (*e.g.*, with polycarbonates), or for the preparation of composites.
The third member of this family, poly(ethylene naphthalate) (PEN), was commercialized much later. Nevertheless, it turned out that it has unexpected horizons of application, arising mainly from its higher glass transition temperature and from its superior barrier properties. PEN demonstrates even more convincingly the unique properties of thermoplastic polyesters.
An international team of scientists, having a many years' experience with polyesters, their copolymers, blends, and composites, undertook this attempt to highlight the peculiarities of this class of synthetic polymers. The motivation for this effort was the common belief that the application opportunities of polyesters are still not exhausted. By means of both chemical and physical modifications, it is possible not only to improve the end-use properties of the final products, but also to find new applications. In this respect, the potential for recycling, based on the reactivity of polyesters with polycondensates and functionalized polyolefins, is of particular importance.
As the Editor, I have enjoyed working with the individual contributors and have greatly appreciated their support, prompt response, and patience. My special thanks are extended to Prof. Dr. J. Karger-Kocsis for his advice during all the stages of realization of this project.
This book could not have been produced without the constant support of my colleague of many years, Mrs. S. Petrovich, who has maintained contact with contributors, polished the English, and helped in the processing of the book. For this I express my sincere gratitude.
The Authors, the Editor, and the Publisher would like to cordially thank all those publishers, who generously gave their permission to reprint materials from their own publications. Details are given at the end of the book.
Last but not least, thanks are due to the Alexander von Humboldt Foundation for the "Humboldt Research Award", who made possible the sabbatical stay of the Editor at the Institute for Composite Materials Ltd., University of Kaiserslautern, Kaiserslautern, Germany, where this project was finalized.

S. Fakirov
Sofia – Kaiserslautern, May 2001

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