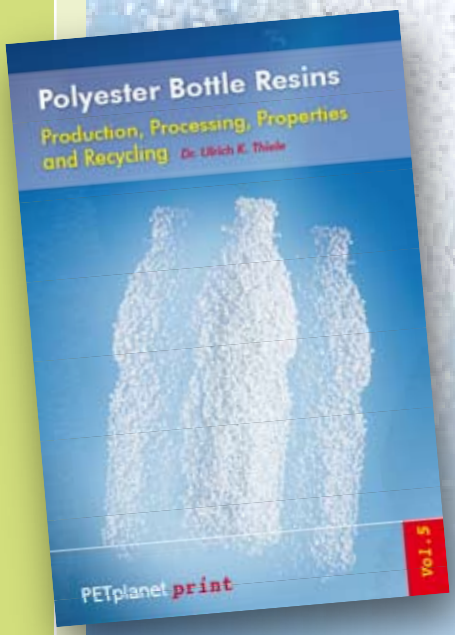
PET – its production, composition, quality analysis and processing



"Polyester bottle resins - Production, Processing, Properties and Recycling" is the title of a recently published book in the "PET-planet Print" series. As the title suggests the new book is a comprehensive examination of PET production and processing, focussing in particular on bottle resin.

The author of the book, Dr Ulrich Thiele, is an acknowledged international expert on the subject of polyesters. Today he is head of the Polyester Technology consulting service in Bruchköbel, Germany. Before establishing an independent consulting service Dr. Thiele was engaged for more than 30 years in almost all facets of polyester production, R&D and recycling.

Specifically the new book covers:

- PET resin production
- Resin types and their composition
- Resin quality and its impact on the final product
- Physical and chemical analysis of PET resin
- The handling and processing of PET resin
- Additives - what they are and an outline of their uses
- Polyester bottle recycling
- Alternative bottle and packaging polymers.

So what exactly is DMT?

This, and many other similar questions are asked every day by PET resin users. The author presents scientific information in a mature way, without over-simplification. For example, in the chapter on PET production he details all of the raw materials and answers such questions as "What is DMT?", "What role do co-monomers play?"

The way that PET is produced from the basic building blocks is fully described, with a clear explanation of melt phase polycondensation (MPP) and solid state polycondensation (SSP). The explanations are backed up by equations for those who wish to understand the processes in more depth.

Why so many kinds of PET resin?

We all know that mineral water packaging does not require the same grade of resin as, for example, a carbonated beverage - but why? What are the fundamental differences between the various grades, and how is IV and AA content controlled and adjusted. A key aspect of PET bottle manufacture is crystallisation. Dr. Thiele explains why a higher level of crystallisation is important for hot fill applications, and why heat set resins contain lower levels of co-monomer, and less DEG.

Is the resin fit for purpose?

The characterisation and quality control of PET resin and intermediate or final products calls for numerous analysis methods and related laboratory hardware. The successful execution of such methods also requires well-trained laboratory technicians. With PET resin becoming more and more a standard bulk material, and bottle production today being a highly competitive mass-market activity, expenditure on quality control tends to be kept to a minimum. From this point of few it is important to establish what is the "right" amount of analytical work

in relation to the business of the resin processor. Selective combination of methods, cooperation, external expertise and close relations with suppliers are all aspects discussed in the book. Dr Thiele gives some initial guidelines for the establishment of a laboratory for chemical and physical analysis of PET resin, and the type of tests that can be carried out. Since this is not a realistic proposition for most small converters an extensive listing of contract analytical labs is also given.

Storage, handling and preparation for processing

Having accepted a shipment of PET resin it is important for the converter to treat the material correctly. PET is susceptible to degradation in many ways, including friction and overheating during conveying, which can result in fish-eyes, specks, and other quality defects in the preform. The author points out some of the dangers and common mistakes that converters make in storing and conveying resin within the plant, and makes specific recommendations in this respect.

The drying of the resin is a critical aspect of PET processing and one which is considered in some depth, differentiating between the drying of amorphous pellets and the drying of SSP pellets. The drying of amorphous pellets is carried out in two steps - crystallisation and drying. SSP pellets are always crystalline, and so call for a different drying process.

Additives

The wide range of applications for PET means that the standard material frequently has to be modified to provide optimum performance characteristics. The additives that are used may be CO_2 and oxygen barrier, colours, UV and IR absorption, AA or oxygen scavengers, antistatics, anti-friction additives etc. Dr. Thiele's book lists the various PET additives which are used for specific purposes and explains their function, as well as pointing out any negative side effects.

Recycling

Following initial pioneering work on PET recycling in the 1970s new recycling processes and companies popped up like mushrooms during the 1990s. Nevertheless the variety of PET materials, additives and blends means that the increasing popularity of PET enjoyed by the resin producers is becoming an increasing nightmare for the recycling industry and calls for sophisticated sorting and decontamination technologies.

Dr Thiele reviews the current status of post-consumer PET collection, flake production and recycling and the various technologies in use. He makes regional comparisons, provides estimates of future growth, and lists equipment and system suppliers.

Can PET be replaced?

An alternative to standard PET resin would be a second polymeric material which is able to replace PET resin in all of its applications. According to this definition there is no real alternative at the moment. Nevertheless other polymeric materials of similar properties in processing at a comparable price level and useful for specific applications can be obtained. The last chapter of the book looks one by one at these alternatives, including metallocene-based polypropylene, and of course PLA, together with their thermal data and their potential uses.

Taken altogether this new PETplanet Print publication is a genuinely useful book for processors, converters and bottle blowers, as well as students and trainees in the plastics packaging industry. It is a technical introduction to the whole spectrum of PET production and processing, presented in a clearly-expressed manner that not only describes the way that PET behaves along its journey from the manufacturing plant to the filling line, but also explains the "hows" and the "whys".

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Production, Processing, Properties and Recycling

Dr. Ulrich K. Thiele

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