

Preface

Most books about plastics are written by professors who explain the behavior of these materials through their chemical contents and their mechanical properties from mathematical concepts. These approaches are of interest for research, but they are far removed from the daily problems of converters or users who need practical advice.

There are few books offering a complete technical analysis of converting processes. The books that exist generally mention only the standard processes of injection molding or extrusion. There are actually more than 20 basic techniques, most of them with specific derivative developments, which are increasingly functional.

Unfortunately, the trade experts are too busy and they fail to describe their practices, or they do so only for their own techniques. Therefore, many processes are simply ignored by potential users.

The purpose of this book is thus to analyze in an almost fully exhaustive way, the many processes now practiced, or under development, covering both the assembling and the specific treatments.

In order to do so, this book covers, for each of the major converting process techniques:

- the polymers used;
- the process principle, with its advantages and limitations;
- the description of the manufacturing equipment, molds, machines and all accompanying devices;
- characteristics of the converting process, pressure, temperature, vacuum;

x Plastic Forming Processes

- current operational characteristics, dimensions, output rate, waste, runs;
- typical or specific applications;
- and development trends.

In order to describe this in a practical way, the book contains 400 drawings and pictures to describe the various processes.

Chapter 1

Introduction

The volume of all the items and components made of synthetic materials in the world today is larger than the volume of metal parts. The manufacture of industrial products is not measured in weight, because the objective is not to make masses but to make parts and/or functions.

Future history books will thus say that the Iron Age gave way to the Manmade Age in the 1980s.

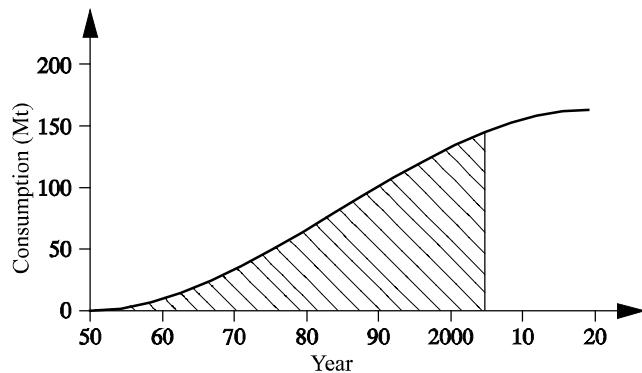


Figure 1.1. Trend of world consumption of plastics polymers

Today electricity and electronics would not exist without these materials which, thanks to their insulating properties, have made their development and miniaturization possible; a result that ceramics could not achieve.

2 Plastic Forming Processes

Plastics materials can be found in all industries, just like steel: automobiles, railroads, boats, aircraft, electricity/electronics, household appliances, sports and leisure, health, building construction and civil engineering, textiles, agriculture, packaging, etc. Other materials generally focus on some specific end-uses: paper and cardboard are used 50% in packaging and 50% in writing, glass is used two thirds in bottles and one third in building construction, two thirds of rubber is used in tires, 100% of concrete and cement are used in building and civil engineering.

The success and development of plastics materials was boosted by a number of causes:

- the lower prices that could be achieved in mass-produced articles, with the possibility of obtaining a finished product with function integration, in one single operation, and quickly, while reducing the number of parts, thus making a single material product. With the non-plastics materials previously used, the process took several steps, melting or forging, then machining, then assembling;
- lighter products, particularly in packaging, handling, transportation, for which this is a major issue, plus the miniaturization that could be obtained;
- the new physical and chemical properties which widened the range of possible applications, and, among others, have largely contributed to the development of electricity/electronics.

Moreover, the full energy balance of the components made of plastics remains low compared to that of other materials. All plastics actually consume only 5% of oil, a very marginal share compared to the bulk of oil used in transportation and heating.

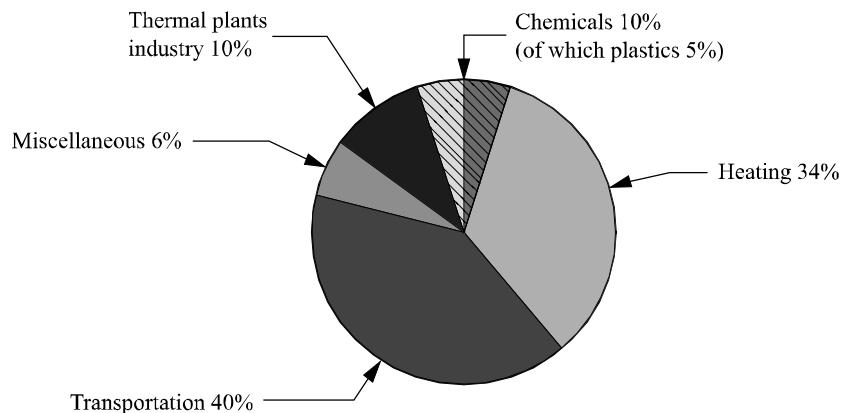


Figure 1.2. Split of oil consumption in Europe