1. Introduction

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1.1 Why this Book?

Product design has become a growing field of interest during the last years. Since the outstanding book of Cussler and Moggridge "Chemical Product Design" published in 2001, many papers have been presented at conferences and submitted to journals that have product desgin in their titles. Actually, most of them present scientific results and new technologies under the umbrella of product design using a very broad interpretation of the word product but not considering any product-design principles. Unfortunately, it is very common in these days to sell one's own work under popular buzz words, like, for example, process intensification or sustainable development.

The goal of this book is to demonstrate that chemical product design is much more than a buzz word and is of the highest importance for chemistry and chemical engineering research in the future. Even more it is vital for the related industries. In Part I the basics and fundamentals of chemical engineering are described that are essential for product design and engineering. The second part describes recent applications that turn the technologies described in Part I into customer-oriented products.

1.2 Why is Chemical Product Design Important?

Following the definition by Kotler and Bliemel a product is something that can be offered to a market in order to fulfill the requirements of a customer [Kotler and Bliemel, 2006]. This very fundamental and broad definition of a product includes already the most important issue: the customer's needs and requirements. In the middle of the last century the markets were created and driven by the new technologies and developments that came merely from science and engineering. New materials like, for example, polymers were developed without any preparatory marketing investigations. The new technology leads to a new product that creates a

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completely new market and also really new employment. People often call this the technology-push area.

Looking at the markets out in the chemical-engineering field today we have to observe that markets are well established and quite saturated. The bulk chemicals and commodity business is characterized by rationalization of workflows to reduce costs to be competitive. The recently increasing prices of raw materials will make this business even harder.

Looking at specialty chemicals we can also see trends of a cut-throat competition of production technologies. It is likely that chemical-product routes will become more and more substituted by bio-based processes that are getting more and more competitive. The production of riboflavin, vitamin B2, is such an example. The increasing oil prices and the discussion about CO_2 emissions related to global-warming issues will strenghten this trend towards a bio-based society. But also new production processes in a cut-throat competion market will lead to no increase of employment. Jobs that are created in the new production process will be lost by shutting down the old one.

Many traditional chemical companies have already responded to these new developments and are currently adapting their structure to the new requirements. Over its 100-year history DSM, for example, has transformed from a local coal-mining operation to a chemical commodity producer. After the divestments of the petrochemical activities in 2002 and Bakery Ingredients in 2005, the recent inclusions of DSM Nutrional products (formerly Roche Vitamins and Fine Chemicals) in 2003 and the recent acquisition of NeoResins DSM has now a portfolio that comprises around 80% specialities [Laane and Sijbesma, 2006].

The development within DuPont is similar and is sketched in Fig. 1.1. Starting with explosives in the 19th century, turning to chemicals in the 20th century DuPont sees the future in multidisciplinary knowledge-intensive solutions required by the customers of the 21st century.

DuPont's future strategy clearly shows the importance of product design and engineering in the future of the Process Industries. Customers' demands have to be

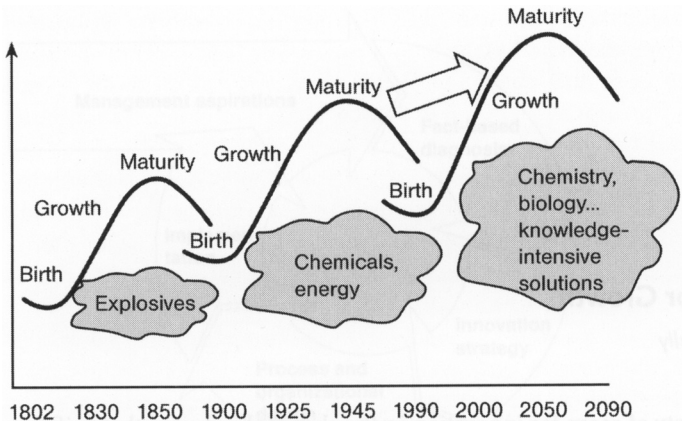

Fig. 1.1 DuPont business life cycle over time (Source: [Connelly, 2006])

recognized and turned into products by the help of well-established processes and technologies. Fulfilling customers needs will automatically lead the business to new markets where real growth and new employment is created. Some people call these blue-ocean markets where new fields are opened and competition does not exist [Kim and Mauborgner, 2005. Part II of this book series shows some examples of these new products with an introductory chapter on Product Design Fundamentals.

1.3
Structure of the Book Series

As already mentioned the two parts of this book series deal with basics, fundamentals and technologies in the first and additives and products in the second volume. Figure 1.2 shows the structure of the book and also the proportion of the single topics. It is obvious that technologies, additives and products form the main part of the book, based on a brief presentation of the fundamentals.

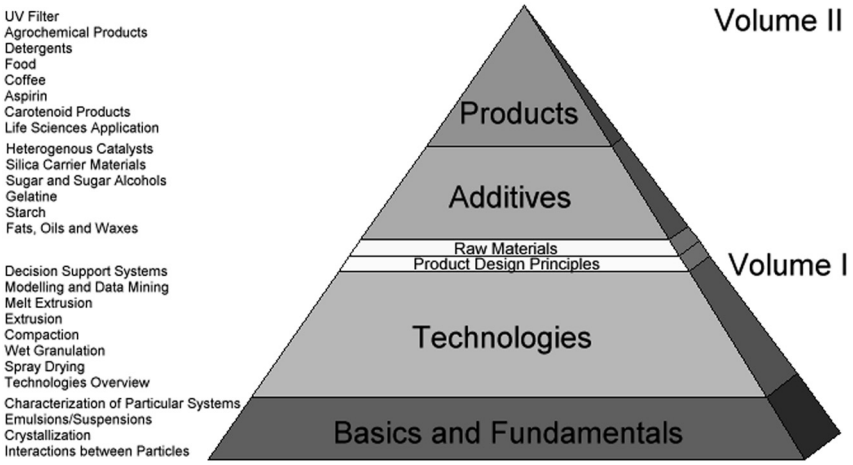

Fig. 1.2 Structure and contents of the book series

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