

THIRD EDITION

TEXTILES CONCEPTS AND PRINCIPLES

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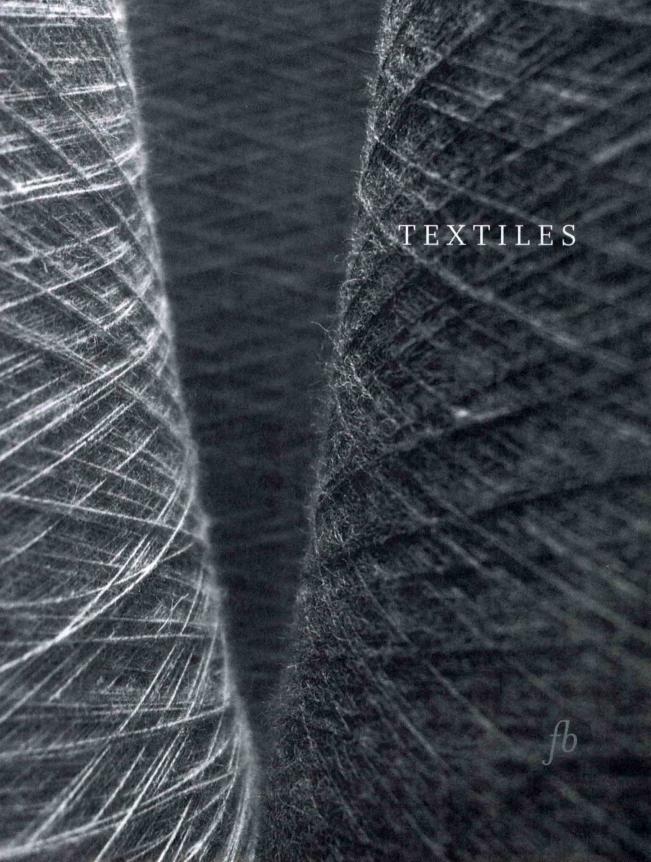
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Textiles: Concepts and Principles, Third Edition, introduces students to textiles in a readable, nontechnical style. The challenge was to present complex information in an easy-to-comprehend format that would allow students to gain an appreciation for the beauty and serviceability of textiles without a preponderance of technical information.

TARGET READERS

This book is designed to be an introduction to textiles for students who are planning to enter careers that require a basic knowledge of textiles. These careers may include interior design, fashion design or merchandising, costuming, textile marketing, product development, buying, and retailing. Information relevant to both furnishings and apparel is included. Industrial applications are also included but not emphasized.

OBJECTIVES

The objectives of this book are that the student will be able to:

- List laws and regulations affecting the textile industry
- 2. Identify fibers, yarn formation, and fabric structure
- Recognize the impact of coloration and finishes on the final product
- Predict performance of particular textiles based on an understanding of the relationship between fiber, yarn, fabric, coloration, and finish
- Select textile products based on end use, care, and customer expectations
- Understand the relationship between production processes, selection criteria, cost, and customer satisfaction
- 7. Use textile terminology accurately
- 8. Recognize the impact of the textile industry on the ecosystem

COMPONENTS

The organization of the book is based on the components of textile products: fibers, yarns, fabric formation, coloration, and finishes. Chapter 1 presents an overview of the global textile industry, introduces the components of textile products, summarizes laws and regulations affecting the textile industry, and looks at career possibilities in the textile industry.

The properties of the fibers, which are presented in Chapters 2 through 6, form the basis for the behavior of textiles. Each fiber's properties, care instructions, and end uses are explained. Since the properties of manufactured fibers can be controlled during production, the properties of these fibers are discussed in general terms.

Yarn and fabric formation, coloration methods, and finishing processes are presented in Chapters 7 through 12. The interrelationship of the components of textiles and the contribution of each component to the final product are emphasized. It is important to remember that the appropriateness of a textile product must be evaluated in terms of the needs and desires of the consumer. Chapter 13 discusses the overall impact of the production and use of textiles on the environment.

LEARNING FEATURES

Photographs, diagrams, tables and At a Glance boxes are used to provide visual reinforcement and to illustrate the information in the text. Key words are highlighted in the text. Each chapter includes one or more boxed Industry Statements that contain news about products and materials. Chapters conclude with a summary of the main points, a list of key terms, review questions, and learning activities. The glossary provides easily accessible information that will make this text a valuable reference for the nontechnical student of textiles.

A supplemental laboratory book is found in the appendix. The reader is encouraged to become immersed in the study of textiles through hands-on laboratory assignments. The appendix includes laboratory activities, suggested safety rules, and laboratory equipment and supply lists.

I hope this book will provide students with an enjoyable learning experience and instructors with an enjoyable teaching experience.

ACKNOWLEDGMENTS

This book would not have been possible without the contributions of many people, several of whom deserve special thanks.

First, my family. I mention them first because they have encouraged me every day since the beginning of the first edition of this book. My daughter Meghan's special sense of humor provided comic relief when needed; my son, Christian, patiently taught me the intricacies of word processing and Internet research; and my husband, Neil, showed his unfailing kindness and continuing support by his willingness to accept additional responsibilities at home. And, although they are not here to accept my appreciation for years of encouragement, I thank my parents, Robert and Jean Hencken, and my father-in-law and mother-in-law, Cornelius and Ruth Elsasser, Jr.

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INTRODUCTION TO TEXTILES

INTRODUCTION

The purpose of this book is to help the reader understand the importance of textiles in society, appreciate the visual and tactile beauty of textiles, and identify the characteristics of textile products. With this knowledge the reader will be able to predict appropriate end-use applications accurately and make informed design, merchandising, and retailing decisions.

SCOPE OF THE GLOBAL TEXTILE INDUSTRY

The textile industry, which encompasses every aspect from raw fiber production to final consumption of the product, is a fascinating blend of science and technology, art and design, and business. The textile industry is a global industry. Design, production, and consumption occur worldwide. It is possible for a garment to be designed in New York City, manufactured in China with fabrics from Europe, and then sold in Australia.

The textile industry in the United States and Europe has declined in recent years because of the high cost of production when compared with that of less-developed countries. Production has shifted to areas where the costs are significantly less. In addition, with the elimination of import quotas for textiles and apparel in 2005, competition has increased. The American and European textile industries have responded to the competition from imports by increasing the use of automation. This reduces cost and allows for prompt delivery of goods, especially to the retail sector. The United States has initiated campaigns to promote domestic goods and laws requiring labels to indicate the product's country of origin. Some companies have expanded globally by opening facilities in other countries, such as China. Industry Statement 1.1 discusses INVISTA's announcement of a technology licensing agreement with the Chinese company Chongqing Jian-Feng Industrial Group Co., Ltd.

Science and Technology

Science and technology have created an ultramodern textile industry that is capable of engineering products to meet specific demands. Wrinkle-free clothing, lightweight bulletproof vests, and artificial replacements for diseased veins and arteries are examples of textile products that meet specific needs. Increased automation and mechanization have reduced production time and improved efficiency.

In addition to creating new products, the textile industry is working to improve the environment. Some recent developments include improved methods for spinning manufactured fibers and reducing water, air, and noise pollution. Manufactured fiber producers have begun to recycle plastic bottles into fibers that are used in apparel and furnishings. Cargill Dow and DuPont have also developed fibers created from corn, a renewable resource. Because the polymer base of the fiber is created from corn instead of petroleum products, the use of these fibers reduces our dependence on oil.

New developments in nanotechnology have created superior finishes, such as soil resistance, that do not affect the aesthetics of the fabric and that provide superior performance, as well as dyes and pigments that have less impact on the environment. **Nanotechnology** is the science of working with very small materials that are between 1 and 100 nanometers: a nanometer is one billionth of a meter, a **nanoparticle** is one million times smaller

INVISTA and Jian-Feng Sign BDO, PTMEG License Agreement for RMB 2 Billion (\$300 Million) Project

New York, NY—August 20, 2009—INVISTA, a world leader in chemical intermediates, polymers and fibers, signed a technology licensing agreement with Chongqing Jian-Feng Industrial Group Co., Ltd., to license its BDO and PTMEG manufacturing technologies to the Chinese company.

Jian-Feng is investing RMB 2 billion (approximately \$300 million US) in building a manufacturing complex to produce these two products at Chongqing Chemical Industry Park in the Fuling District of the Chongqing Municipality.

Mr. Li Xian Wen, vice general manager of the Jian-Feng Industrial Group, and Mr. Jeff Gentry, chairman of the board of directors and CEO of INVISTA, participated in a signing ceremony held here today for the licensing deal. Also present were senior representatives from both companies and senior government leaders from the Chongqing Municipality, including Mayor Wang Hongju.

"We are proud to support Chongqing's continuing technological and industrial development through our licensing of BDO and PTMEG technologies," said Gentry. "We admire the clear vision for Chongqing's continued growth as an industrial center being advanced by Mayor Wang and other Chongqing leaders."

The licensing agreement covers the manufacturing processes, required technologies, product formulations as well as expert engineering services for the two plants with annual capacity of 60,000 tons of BDO and 46,000 tons of PTMEG.

"Our technology licensing organization, INVISTA Performance Technologies, has over 40 years of technology transfer experience and has participated in over 40 projects in China," said Gentry.
"We are pleased to provide Jian-Feng with the design and know-how for its manufacturing operation in Chongqing."

Chemical intermediate BDO (1,4 butanediol) is used in making polyester resins and polyurethanes, and PTMEG (polytetramethylene ether glycol) is a polyether glycol used as a building block in high-performance polyurethanes, polyesters, co-polymers and other

polymers. Typical end uses for PTMEG include spandex fibers, thermal plastic elastomers, and cast elastomers for apparel, automotive and industrial uses.

INVISTA has been licensing its leading technologies in chemical intermediates and polymers in China since 1990. The total investment of INVISTA's Chinese licensees has now exceeded RMB 32 billion.

Source: Stutzman, Jodie. "INVISTA and Jian-Feng Sign BDO, PTMEG License Agreement for RMB 2 Billion (\$300 Million) Project." INVISTA. http://www.invista.com/news_releases/2009/pr_090820_PTMEG.shtml (accessed January 6, 2010).

than a grain of sand, and a **nanofiber** is 0.001 micrometer. Nanoparticles and nanofibers have application in textiles. Nanoparticles are in finishes. Because less chemical is used in the finishing process, there is less impact on the environment. Nanofibers are used in filters and also in specialty fabrics for medicine.

Art and Design

Textile and apparel designers create fabrics and garments that are both beautiful and functional. Computer-aided design, new classifications of dyes and pigments, and hightechnology fibers and fabrics have provided designers with increasing opportunities and challenges.

Business

The textile industry is profit-driven and therefore must respond to the needs of each customer. The customer may be a final purchaser of consumer or industrial textile products or an intermediate purchaser along the product pipeline. Figure 1.1 illustrates the product pipeline for consumer textiles, from fiber production to final customer. Each step along the pipeline depends on and relates to every other step. Business management and

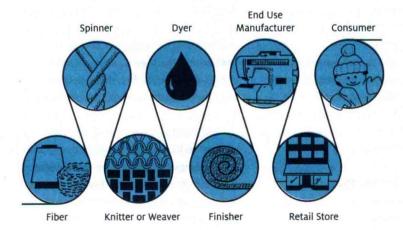


Figure 1.1
Product pipeline for consumer textiles.
(Courtesy of DuPont, Wilmington, DE.)