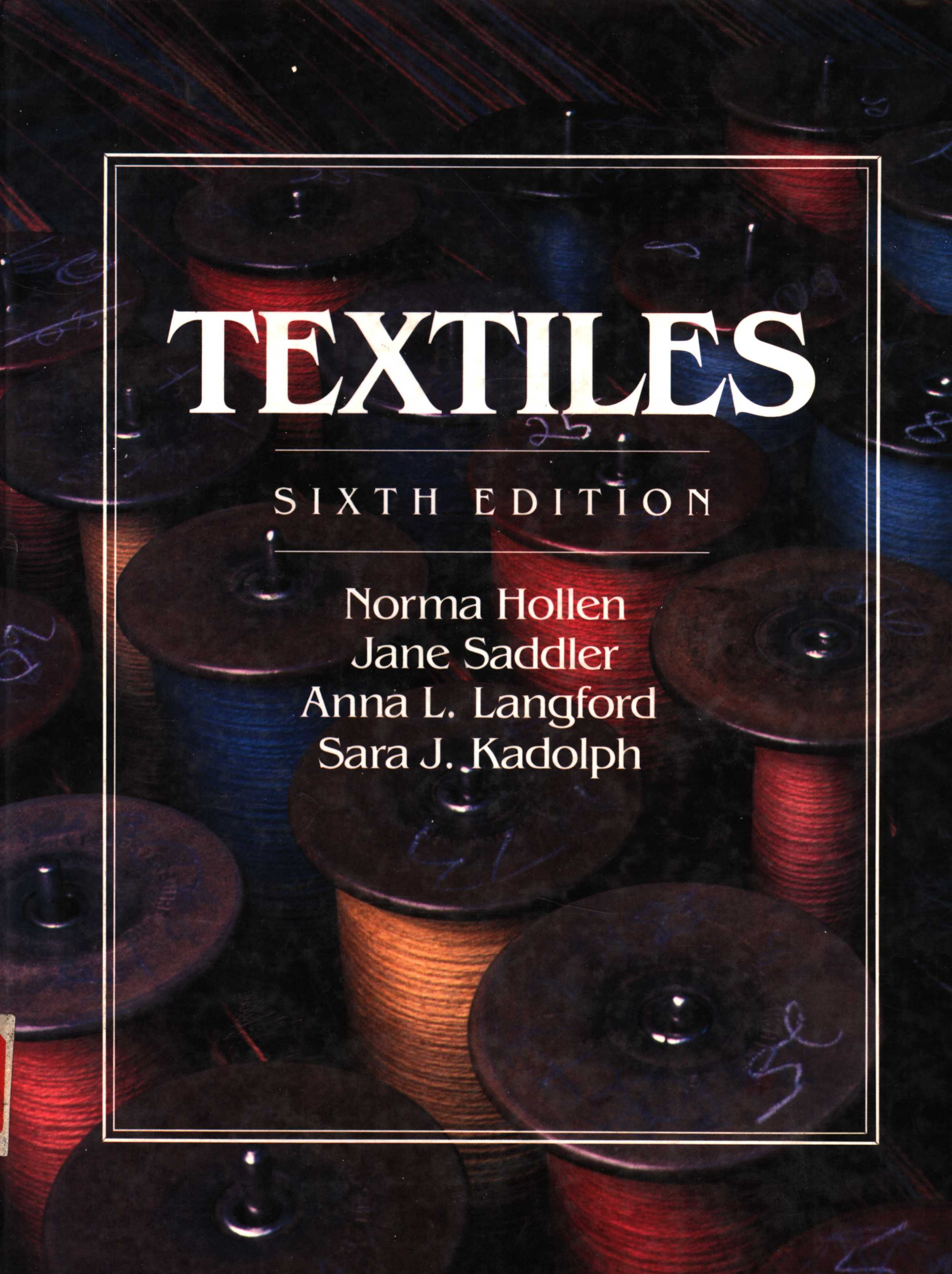

TEXTILES

SIXTH EDITION

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Jane Saddler
Anna L. Langford
Sara J. Kadolph

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Preface

This text was written for use in an introductory or single college course in textiles. It provides a broad view of the production and utilization of fabrics with emphasis on consumer values and serviceability.

The text is organized in a logical manner. It deals with textile-related terms, fibers, yarns, fabrication methods, finishes, and care. However, each section of the text is complete enough that any order can be used in presenting the material for study.

The sixth edition of *Textiles* has been revised to include new developments in fibers, yarns, fabrication, and finishes. A new chapter on care has been added because of the importance of understanding how to properly clean and store textile products. The book has been reorganized to present more cohesive units and to keep like material together. For example, man-made fibers and fiber modifications have been combined into one chapter. This new chapter comes before any of the man-made fibers. In addition, all woven chapters are grouped together. The two knit chapters follow the woven fabrics, and the finish chapters have been reorganized. An overview of finishing is presented first, followed by aesthetic finishes, special-purpose finishes, flame-retardant finishes and flammability, and dyeing and printing.

We have tried to maintain the strong points of the book, while correcting the weak points. It is not specific to textiles and clothing majors, but is useful for students who will be working with textile products. Interior design and education students will find much useful information in the book.

The book does not require a physical science background. Technical information is presented to assist the student in understanding the material and to provide background information to those students who have had courses in chemistry.

Illustrations assist in understanding the material. Hence, many illustrations are included in the text. Both photographs and drawings are included to represent actual fabrics and production machinery and to clarify details in the fabric and in production of the fabric.

This text will help students to do the following:

- Use textile terminology correctly.
- Know current laws and labeling requirements that regulate textile distribution.
- Understand how production processes affect the characteristics and cost of textile products.
- Appreciate past developments in textiles and recognize the need for future developments.
- Identify fibers, yarns, and fabrics by analysis and some simple procedures.
- Predict fabric performance based on knowledge of fibers, yarns, fabric constructions, and finishes in conjunction with informative labeling.
- Make wise selections of textile products for specific end uses.

- Care for textile products in a satisfactory manner.
- Develop an interest in textiles that will motivate further study.

A student swatch kit has been developed by Textile Fabric Consultants to use in conjunction with this edition of *Textiles*. It is available through Textile Fabric Consultants, P.O. Box 111431, Nashville, TN 37222.

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Finally, we would like to thank those members of the textile industry who have provided information, diagrams, and photographs.

N. H.
J. S.
A. L. L.
S. J. K.

Contents

1

Introduction

This chapter begins the detailed study of textiles and the properties they contribute to fabrics, apparel, furnishing, and industrial textiles. A good starting place is the definitions of the component parts of a textile fabric.

Fiber Any substance, natural or man-made, with a high length-to-width ratio and with suitable characteristics for being processed into a fabric.

Yarn An assemblage of fibers, twisted or laid together so as to form a continuous strand that can be made into a textile fabric.

Fabric A planar substance constructed from solutions, fibers, yarns, fabrics, or any combination of these.

Finish Any process used to convert gray goods (unfinished fabric) into finished fabric.

Food, shelter, and clothing are the basic needs of everyone. Most clothing is made from textiles, and shelters are made more comfortable and attractive by the use of textiles. In fact, some shelters are made from textiles. Textiles are used in the production or processing of many things used in day-to-day living, such as food and manufactured goods.

We are surrounded by textiles from birth to death. We walk on and wear textile products; we sit on fabric-covered chairs and sofas; we sleep on and under fabrics; textiles dry us or keep us dry; they keep us warm and protect us from the sun, fire, and infection. Clothing and furnishing textiles are aesthetically pleasing, and they vary in color, design, and texture. They are also available in a variety of price ranges.

The industrial and medical uses of textiles are many and varied. The automotive industry, one of the largest industries in the United States, uses textiles to make tire cords, upholstery, carpeting, head liners, window runners, seat belts, and shoulder harnesses.

Man has traveled to the moon in a 20-layer, $100,000 space suit that has nylon water-cooled underwear. Life is prolonged by replacing wornout parts of the body with woven- or knitted-fabric parts such as polyester arteries and velour heart valves. Disposable garments are worn by doctors and nurses. Bulletproof vests protect police, hunters, and soldiers, and safety belts make automobile travel less dangerous. Three-dimensional, inflatable "buildings" keep out desert heat and Arctic cold.

This text was written for consumers—not average consumers but educated consumers who, when they purchase textile items, want to know *what* to expect in fabric performance and *why* fabrics perform as they do. Textiles are always changing. They change as fashion changes and as the needs of people change. New developments in production processes also cause changes in textiles, as do government standards for safety, environmental quality, and energy conservation. These changes are discussed, but the bulk of the text is devoted to basic information about textile products, with an emphasis on fibers, yarns, fabric construction, and finishes. All of these elements are interdependent and contribute to the beauty, the durability, the care, and the comfort of fabrics.

Much of the terminology used in the text may be new to students and many facts must be memorized. But to understand textiles in a broad aspect one must first learn the basics. The historical development, the basic concepts, and the new developments in textiles are discussed. Production processes are explained briefly. A knowledge of production should give the student a better understanding of, and appreciation for, the textile industry.

In the United States, the textile industry is a tremendous complex. It includes the natural and man-made fiber producers, spinners, weavers, knitters, throwsters, yarn converters, tufters, fiberweb producers and finishers, machinery makers, and many others. More people are employed in the textile industry than in any other manufacturing industry, over 2 million. Textile products valued at over $40 billion are produced each year by systems that are increasingly being directed by computers. In Japan, at the push of a button, an operator can dye wool fabric in over 2,000 color combinations without flaw or error.

The textile industry has developed from an art-and-craft industry perpetuated by guilds in the early centuries, through the Industrial Revolution in the 18th and 19th centuries, when the emphasis was on mechanization and mass production, to the 20th century, with its emphasis on science and technology.

In this century, man-made fibers were developed and modified textured yarns were created. New fabrications and increased production of knits occurred, and many finishes and sophisticated textile production and marketing systems were developed. These developments have been beneficial to consumers. Man-made fibers and durable press finishes have made many items of clothing "easy care." New developments in textiles have also created some problems for consumers, particularly in the selection of apparel and furnishing textiles. So many items look alike. Knitted fabrics look like woven fabrics and vice versa, vinyl and polyurethane films look like leather, fake furs look like real furs, acrylic- and polyester-fiber fabrics look like wool. The traditional cotton fabrics are now often polyester or polyester/cotton blends.

To make textile selection a bit easier for consumers, textile producers and their associations have set standards and established quality-control programs for many textile products. The federal government has passed laws to protect consumers from unfair trade practices, namely, the Wool Products Labeling Act, the Fur Products Labeling Act, the Textile Fiber Products Identification Act, and the Flammable Fabrics Act. The first three laws are "truth-in-fabrics" legislation and, to be beneficial, some knowledge on the part of the consumer about fibers and furs is required. The Flammable Fabrics Act is protective legislation that prohibits the sale of dangerously flammable apparel and furnishing textiles. The Federal Trade Commission issued the Permanent Care Labeling Rule in 1972 and revised it in 1985. Its purpose is to inform the consumer how to care for fabrics and garments.

Emphasis on energy conservation, environmental quality, noise abatement, health, and safety affect the textile industry as well as other industries. The efforts of the textile industry to meet standards set by the federal government affect the consumer indirectly—by raising prices for merchandise or by limiting the choices available. Energy conservation is being achieved by using less water and faster production methods. Nonpollution of streams and air is being achieved by reducing or eliminating the use of water in many finishing processes and by adding equipment to machines to cleanse and purify the water or air before it is emitted. The Occupational Safety and Health Administration has set standards for noise levels and dust and lint levels that make the mills healthier places in which to work. Much progress has been made in providing flame-resistant fibers and finishes in response to the Consumer Products Safety Commission's implementation of the Flammable Fabrics Act. The CPSC also has commissioned the testing of fabrics and finishes for toxicity and carcinogenicity, and it can request that suspect fabrics be removed from the market.

Textile fabrics can be beautiful, durable, comfortable, and easy care. They can satisfy the needs of all people at all times. Knowing how fabrics are created and used will give a better basis for their selection and an understanding of their limitations.

A knowledge of textiles and their production will result in a more informed selection of a textile product for a particular use. A knowledgeable selection will result in a more-satisfied user.

2

Textile Fibers and Their Properties

It is important to understand the factors influenced by fibers because fibers are the basic unit of most fabrics. Fibers contribute to the aesthetic appearance of fabrics; they influence the durability, comfort, and appearance retention of fabrics; they determine, to a large extent, the care required for fabrics; and they influence the cost of fabrics. Successful textile fibers must be readily available, constantly in supply, and inexpensive. They must have sufficient strength, pliability, length, and cohesiveness to be spun into yarns.

Textile fibers have been used to make cloth for the last 4,000 or 5,000 years. Until 1885, when the first man-made fiber was produced commercially, fibers were obtained from only plants and animals. The fibers most commonly used were wool, flax, cotton, and silk. These four natural fibers continue to be used and enjoyed today, although their economic importance relative to all fibers has decreased.

Textile processes—spinning, weaving, knitting, dyeing, and finishing of fabrics—were developed for the natural fibers. Man-made fibers often resemble the natural fibers.

For example, silk has always been a highly prized fiber because of the smooth, lustrous, soft fabrics made from it; it has always been expensive and comparatively scarce. It was, therefore, logical to try to duplicate silk. Rayon (called artificial silk until 1925) was the first man-made fiber. Rayon was produced in filament length until the early 1930s when an enterprising textile worker discovered that the broken and wasted rayon filaments could be used as staple fiber. Acetate and nylon were also introduced as filaments to be used in silk-like fabrics.

Many man-made fibers were developed in the first half of the 20th century, and from that time onward tremendous advances have been made in the man-made fiber industry, primarily modifications of the parent fibers to provide the best combination of properties for specific end uses. The man-made fibers most commonly used today in apparel and home-furnishing fabrics include polyester, nylon, olefin, acrylic, rayon, and acetate.

Fiber Properties

Fiber properties contribute to the properties of a fabric. For example, strong fibers contribute to the durability of fabrics; absorbent fibers are good for skin-contact apparel and for towels and diapers; fibers that are self-extinguishing are good for children's sleepwear and protective clothing.

To analyze a fabric in order to predict its performance, start with the fiber. Knowledge of the fiber's properties will help to anticipate the fiber's contribution to the performance of a fabric and the product made from it. Some contributions of fibers are desirable and some are not. Figure 2–1 illustrates this fact by identifying some of the contributions of a low-absorbency fiber.

Fiber properties are determined by the nature of the *physical structure,* the *chemical composition,* and the *molecular arrangement.*

PHYSICAL STRUCTURE

The physical structure, or morphology, of fibers can be identified by observing the fiber through a light, or electron, microscope. In the text, photomicrographs taken by electron microscopes at

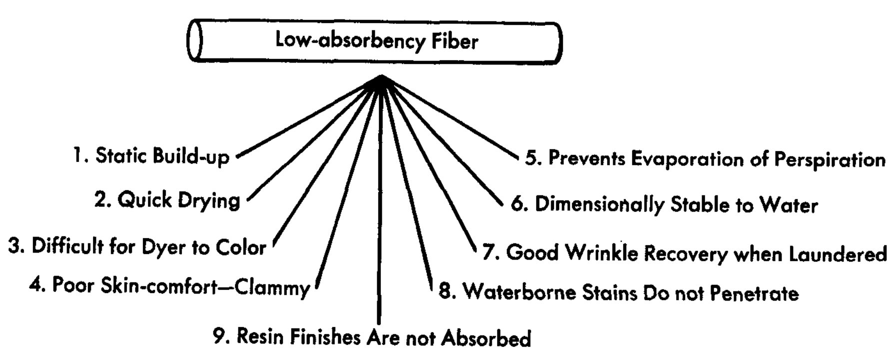


Fig. 2–1 *Properties usually related to low absorbency.*

magnifications of 250–1,000× will be used to clarify details of the fiber's physical structure.

Length. Fibers are sold by the fiber producer as filament, staple, or filament tow. *Filaments* are long continuous fiber strands of indefinite length, measured in yards or meters. They may be either monofilament (one fiber) or multifilament (a number of filaments). Filaments may be smooth or bulked (crimped in some way), as shown in Figure 2–2. Smooth filaments are used to produce silk-like fabrics; bulked filaments are used in more cotton-like or wool-like fabrics.

Staple fibers are measured in inches or centimeters and range in length from 2–46 cm (3/4 of an inch to 18 inches). Staple fibers are shown in Figure 2–3. All the natural fibers except silk are available only in staple form.

The man-made fibers are made into staple form by cutting filament tow into short lengths. *Filament tow* consists of a loose rope or strand of several thousand man-made fibers without a definite twist. Tow is usually crimped after spinning (Figure 2–4).

Diameter, Size, or Denier. Fiber size plays a big part in determining the performance and *hand* of a fabric (how it feels). Large fibers give

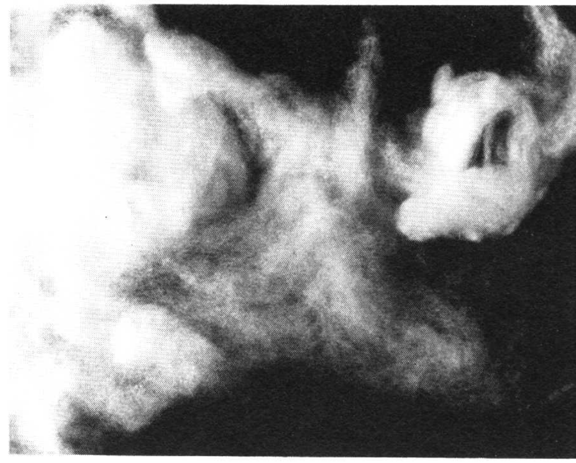


Fig. 2–3 *Man-made staple fiber.*

crispness, roughness, body, and stiffness. Large fibers also resist crushing—a property that is important in carpets, for example. Fine fibers give softness and pliability. Fabrics made with fine fibers will drape more easily.

Natural fibers are subject to growth irregularities and are not uniform in size or development. In natural fibers, fineness is a major factor in determining quality. Fine fibers are of better quality. Fineness is measured in micrometers (a micrometer is 1/1,000 millimeter or 1/25,400 inch).

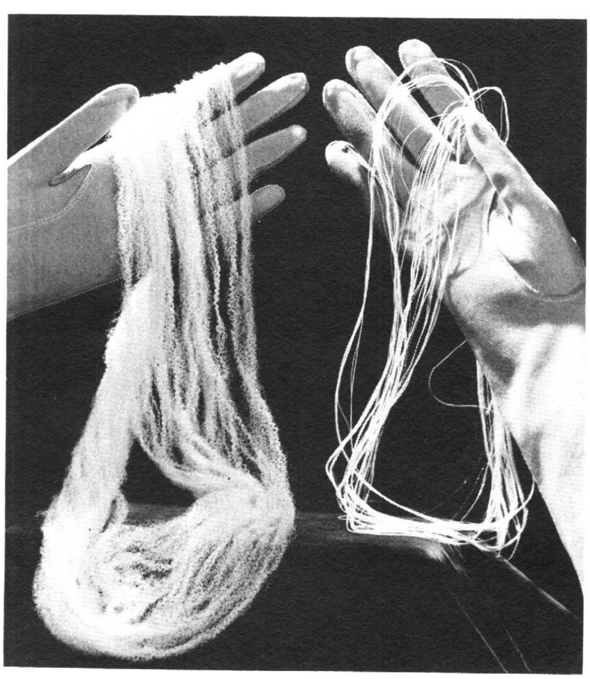


Fig. 2–2 *Man-made filaments: textured-bulk yarn* (left); *smooth-filament yarn* (right).

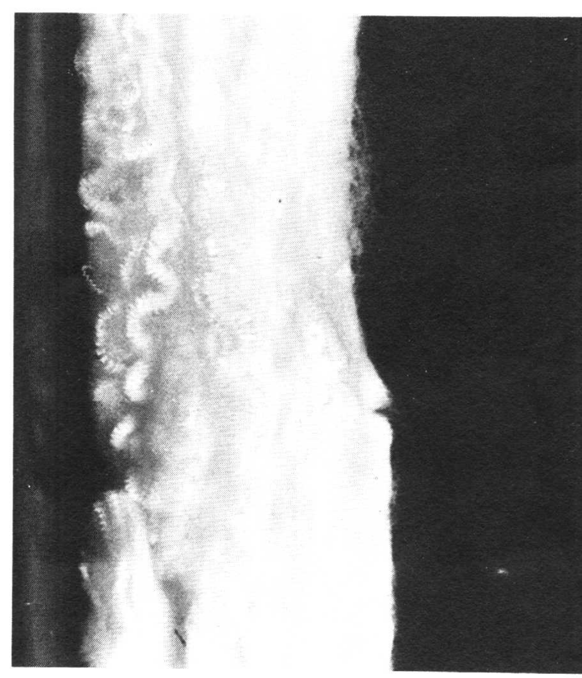


Fig. 2–4 *Filament tow.*

Diameter Range (micrometers)	
Cotton	16–20
Flax	12–16
Wool	10–50
Silk	11–12

In *man-made fibers,* diameter is controlled by the size of the spinneret holes, by stretching or drawing during or after spinning, or by controlling the rate of extrusion of the spinning dope through the spinneret. Man-made fibers can be made uniform in diameter or can be thick-and-thin at regular intervals throughout their length. The fineness of man-made fibers is measured in denier. *Denier* is the weight in grams of 9,000 meters of fiber or yarn. *Tex* is the weight in grams of 1,000 meters of fiber or yarn. Staple fiber is sold by denier and fiber length; filament fiber is sold by the denier of the yarn or tow. Yarn denier can be divided by the number of filaments to give filament denier. For example:

$$\frac{\text{40 denier yarn}}{\text{20 filaments}} = \text{2 denier per filament.}$$

One to 3 denier corresponds to fine cotton, cashmere, or wool; 5 to 8 denier is similar to average cotton, wool, or alpaca; 15 denier corresponds to carpet wool size.

Apparel fibers range from 1 to 7 denier. Fiber of the same denier is not suitable for all uses. Apparel fibers do not make serviceable carpets and carpet fibers do not make serviceable clothing.

Carpet fibers range in denier from 15 to 24. One of the early mistakes made by the carpet industry was that of using clothing fibers for carpets. These fibers were too soft and pliable, and the carpets did not have good crush resistance. Rayon carpet fiber (1953) was the first fiber made especially for carpets, but it is no longer used in carpeting.

Cross-Sectional Shape. Shape is important in luster, bulk, body, texture, and hand or feel of a fabric. Figure 2–5 shows typical cross-sectional shapes. These shapes may be round, dog-bone, triangular, lobal, bean-shaped, flat, or straw-like.

The natural fibers derive their shape from (1) the way the cellulose is built up during plant growth, (2) the shape of the hair follicle and the formation of protein substances in animals, or (3) the shape of the orifice through which the silk fiber is extruded.

The shape of man-made fibers is controlled by the spinneret and the spinning method. The size, shape, luster, length, and other properties of man-made fibers can be varied by changes in the production process.

Surface Contour. Surface contour is defined as the surface of the fiber along its length. Surface contour may be smooth, serrated, striated, or rough. It is important to the luster, hand, texture, and apparent soiling of the fabric. Figure 2–5 shows some of the differences in the surface contours of different fibers.

Crimp. Crimp may be found in textile materials as fiber crimp or fabric crimp. *Fiber crimp* refers to the waves, bends, twists, coils, or curls along the length of the fiber. Fiber crimp increases cohesiveness, resiliency, resistance to abrasion, stretch, bulk, and warmth. Crimp increases absorbency and skin-contact comfort but reduces luster. Inherent crimp occurs wool. Inherent crimp also exists in an undeveloped state in bicomponent man-made fibers where it is developed in the fabric or the completed garment (such as a sweater) by using suitable solvents or heat treatment.

Fabric crimp refers to the bends due to the interlacing or interlooping of yarns in a fabric. When a yarn is unraveled from a fabric, fabric crimp can easily be seen in the yarn. It also may be visible as the yarn is untwisted into fibers.

Fiber Parts. The natural fibers, except for silk, have three distinct parts: an outer covering, called a *cuticle* or skin; an inner area; and a central core that may be hollow. For example, Figure 4–6 and Figure 6–4 show the structural parts of cotton and wool, respectively.

The man-made fibers are not as complex as those of the natural fibers and there are usually just two parts: a skin and a core.

CHEMICAL COMPOSITION AND MOLECULAR ARRANGEMENT

Fibers are classified into groups by their chemical composition. Fibers with similar chemical

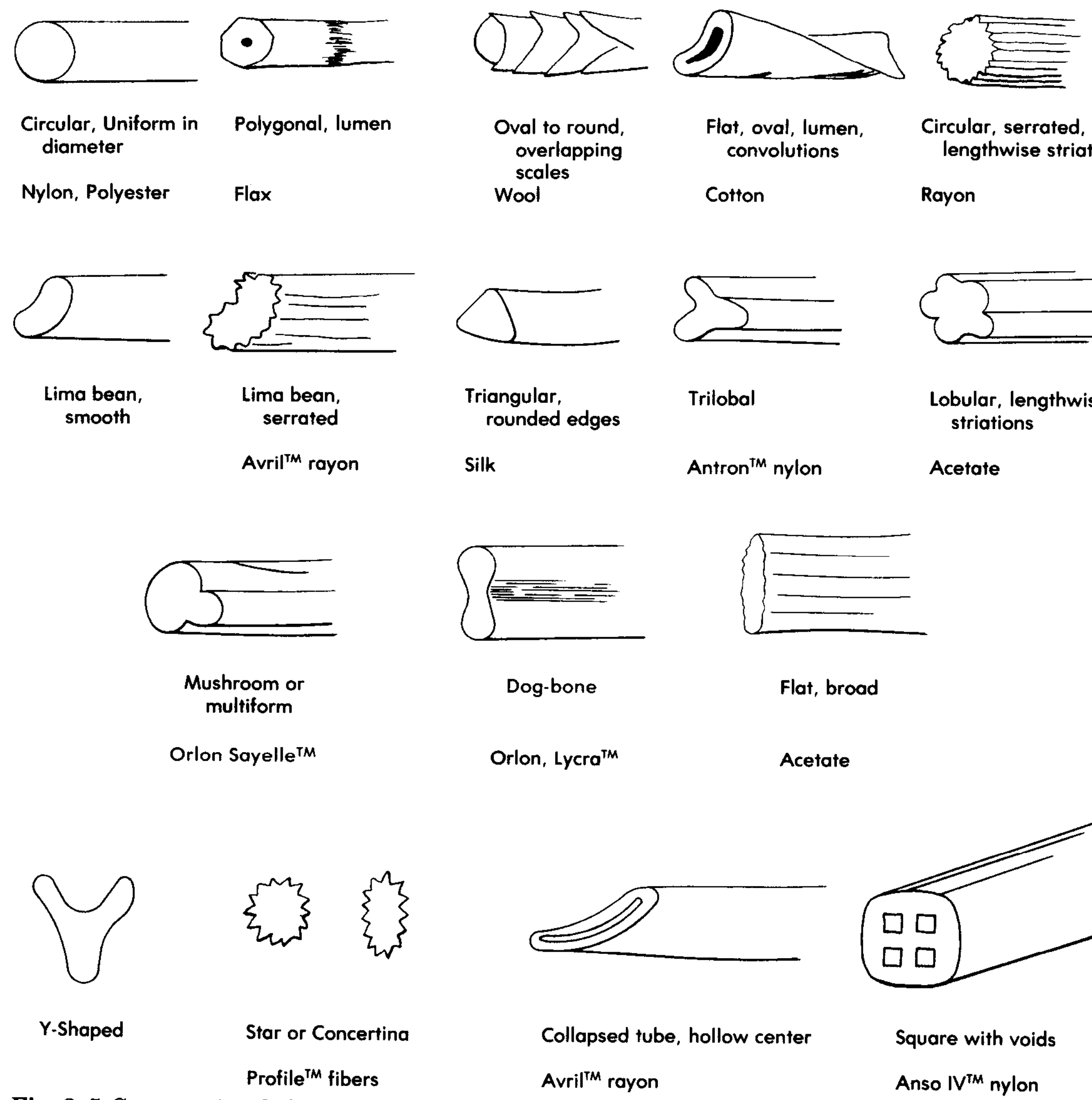


Fig. 2–5 *Cross-sectional shapes and fiber contours.*

compositions are placed in the same generic group. Fibers in one generic group have different properties from fibers in another group.

Fibers are composed of millions of molecular chains. The length of the chains, which varies just as the length of fibers varies, depends on the number of molecules connected in a chain, and it is described as *degree of polymerization.* Polymerization is the process of joining small molecules—monomers—together to form a long chain or a *polymer.* Long chains indicate a high degree of polymerization and a high degree of fiber strength. Molecular chains are not visible to the eye or through the optical microscope.

Molecular chains are sometimes described in terms of weight. The molecular weight is a factor in properties such as fiber strength and extensibility. A fiber of longer chains has a higher strength than a fiber of shorter chains of equal weight; the fiber of longer chains is harder to pull apart than the fiber of shorter chains.

Molecular chains have different configurations in fibers. When molecular chains are nearly parallel to the lengthwise axis of the fi-

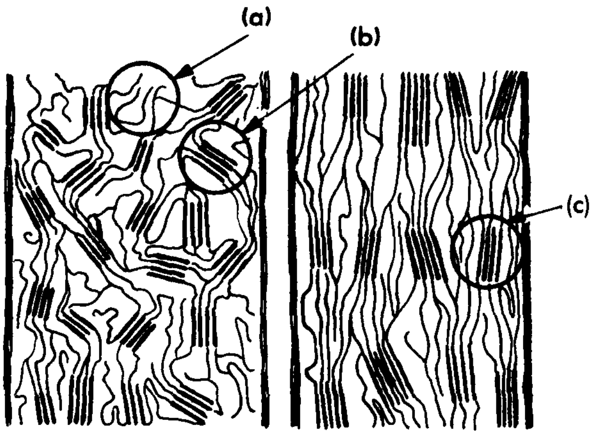


Fig. 2–6 Polymers: (a) amorphous area; (b) crystalline, but not oriented, area; (c) oriented and crystalline area.

ber, they are said to be *oriented;* when they are randomly arranged or disordered, they are said to be *amorphous*. *Crystalline* is the term used to describe fibers that have molecular chains ordered relative to each other, and usually, but not necessarily, parallel to the lengthwise axis of the fiber (Figure 2–6). Different fibers vary in the proportion of oriented, crystalline, and amorphous regions.

The polymers in man-made fibers are in a random, unoriented state when extruded from the spinneret. *Stretching,* or *drawing,* increases their crystallinity and orients them, reduces their diameter, and packs their molecules together (Figure 2–7). Physical properties of the fiber—such as strength, elongation, moisture absorption, abrasion resistance, and receptivity of the fiber to dyes—are related to the amount of crystallinity and orientation.

Molecular chains are held to one another by *cross links* or by intermolecular forces called *hydrogen bonds* and *van der Waals forces*. The forces are similar to the attraction of a magnet for a piece of iron. The closer the chains are together, the stronger the bonds are. Hydrogen bonding is the attraction of positive hydrogen atoms of one chain for negative oxygen or nitrogen atoms of an adjacent chain. Van der Waals forces are similar but weaker bonds. It is in the crystalline area that hydrogen bonding and van der Waals forces occur. Cross links and intermolecular forces help make crystalline polymers stronger than amorphous polymers.

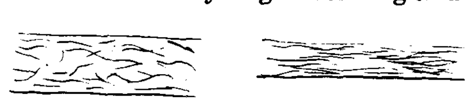


Fig. 2–7 Before and after drawing the fiber.

Serviceability

Textile serviceability includes the five concepts of aesthetics, durability, comfort, appearance retention, and care. Each concept will be discussed in terms of properties that affect it. For example, the aesthetic properties of luster, drape, texture, and hand, as they relate to apparel and furnishing fabrics, will be defined and discussed.

A note to students: Learn the definitions of the properties. Use the tables as you study each fiber in subsequent chapters to see how that particular fiber compares with other fibers. During this process, evaluate your experience with fabrics made of that fiber and try to understand why they performed the way they did. Once you understand the information, you will remember it and use it now and in future years.

AESTHETIC PROPERTIES

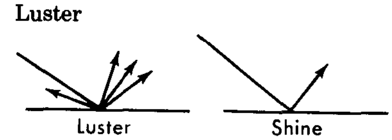
A textile product should be attractive and appropriate in appearance for its end use. Aesthetic properties relate to the way the senses of touch and sight perceive the textile. In evaluating the aesthetics of a textile item, the consumer usually determines whether the item is attractive and appropriate in appearance for its end use.

Luster results from the way light is reflected by a fabric's surface. It is observed by the eye. Shiny or bright fabrics reflect light and are used for certain end uses. Lustrous fabrics reflect a fair amount of light and are used in formal apparel and furnishings. Matte, or dull, fabrics reflect little light and are used most frequently for less-formal looks in apparel and furnishings. Silk fabrics are usually lustrous. Cotton and wool fabrics are usually matte. The luster of man-made fibers can be varied during manufacturing to result in bright, semibright, or matte fibers. Yarn structure, finish, and fabric structure may enhance or decrease the luster of fibers.

Fiber Property Chart

Fiber Property	*Is Due to*	*Contributes to Fabric Property*
Abrasion resistance is the ability of a fiber to withstand the rubbing or abrasion it gets in everyday use.	Tough outer layer, scales, or skin Fiber toughness Flexible molecular chains	Durability Abrasion resistance Resistance to splitting
Absorbency or moisture regain is the percentage of moisture a bone-dry fiber will absorb from the air under standard conditions of temperature and moisture.	Hydroxyl groups Amorphous areas	Comfort, warmth, water repellency, absorbency, static buildup Dyeability, spotting Shrinkage Wrinkle resistance
Aging resistance	Chemical structure	Storing of fabrics
Allergenic potential is the ability to cause some physical reaction, such as skin irritation or watery eyes.	Chemical composition, additives	Comfort
Chemical reactivity is the effect of acids, alkali, oxidizing agents, solvents, or other chemicals.	Polar groups of molecules Chemical composition	Care required in cleaning—bleaching, ability to take acid or alkali finishes
Cohesiveness is the ability of fibers to cling together during spinning.	Crimp or twists, surface properties	Resistance to raveling Resistance to yarn slippage
Cover is the ability to occupy space for concealment or protection.	Crimp, curl, or twist Cross-sectional shape	Warmth in fabric Cost—less fiber needed
Creep is delayed elasticity. Recovers gradually from strain.	Lack of side chains, cross links, strong bonds; poor orientation	Streak dyeing and shiners in fabric
Density—see *Specific gravity.*		
Dimensional stability is the ability to retain a given size and shape through use and care.	Physical structure, chemical structure, coatings	Shrinkage, growth, care, appearance, durability
Drape is the manner in which a fabric falls or hangs over a three-dimensional form.	Fiber size and stiffness	Appearance
Dyeability is the fibers' receptivity to coloration by dyes; dye affinity.	Amorphous areas and dye sites, chemical structure	Aesthetics and colorfastness
Elastic recovery is the ability of fibers to recover from strain. *Elasticity* is another term for elastic recovery.	Chemical and molecular structure: side chains, cross linkages, strong bonds	Processability of fabrics Resiliency Delayed elasticity or creep
Electrical conductivity is the ability to transfer electrical charges.	Chemical structure: polar groups	Poor conductivity causes fabric to cling to the body, electric shocks
Elongation is the ability to be stretched, extended, or lengthened. Varies at different temperatures and when wet or dry.	Fiber crimp Molecular structure: molecular crimp orientation	Increases tear strength Reduces brittleness Provides "give"
Feltability refers to the ability of fibers to mat together.	Scale structure of wool	Fabrics can be made directly from fibers Special care required during washing
Flammability is the ability to ignite and burn.	Chemical composition	Fabrics burn
Flexibility is the ability to bend repeatedly without breaking.	Flexible molecular chain	Stiffness, drape, comfort

Fiber Property Chart *(continued)*

Fiber Property	*Is Due to*	*Contributes to Fabric Property*
Hand is the way a fiber feels: silky, harsh, soft, crisp, dry.	Cross-sectional shape, surface properties, crimp, diameter, length	Hand of fabric
Heat conductivity is the ability to conduct heat away from the body.	Crimp, chemical composition Cross-sectional shape	Warmth
Heat sensitivity is the ability to soften, melt, or shrink when subjected to heat.	Chemical and molecular structure Fewer intermolecular forces and cross links	Determine safe washing and ironing temperatures
Hydrophilic, hygroscopic—see *Absorbency*.		
Loft, or compressional resiliency, is the ability to spring back to original thickness after being compressed.	Fiber crimp Stiffness	Springiness, good cover Resistance to flattening
Luster is the light reflected from a surface. More subdued than shine; light rays are broken up.	Smoothness Fiber length Flat or lobal shape Additives	Luster 
Mildew resistance	Low absorption	Care during storage
Moth resistance	Molecule has no sulfur	Care during storage
Pilling is the balling up of fiber ends on the surface of fabrics.	Fiber strength High molecular weight	Pilling Unsightly appearance
Resiliency is the ability to return to original shape after bending, twisting, compressing, or a combination of the deformations.	Molecular structure: side chains, cross linkages, strong bonds	Wrinkle recovery, crease retention, appearance, care
Specific gravity and density are measures of the weight of a fiber. Density is the weight in grams per cubic centimeter, and specific gravity is the ratio of the mass of the fiber to an equal volume of water at 4°C.	Molecular weight and structure	Warmth without weight Loftiness—full and light Buoyancy to fabric
Stiffness or rigidity is the opposite of flexibility. It is the resistance to bending or creasing.	Chemical and molecular structure	Body of fabric Resistance to insertion of yarn twist
Strength is defined as the ability to resist stress and is expressed as *tensile strength* (pounds per square inch) or as *tenacity* (grams per denier).	Molecular structure—orientation, crystallinity, degree of polymerization	Durability, tear strength, sagging, pilling Sheerer fabrics possible with stronger fine fibers
Sunlight resistance is the ability to withstand degradation from direct sunlight.	Chemical composition Additives	Durability of curtains and draperies, outdoor furniture, outdoor carpeting
Texture is the nature of the fiber surface.	Physical structure	Luster, appearance
Translucence is the ability of a fiber, yarn, or fabric to allow light to pass through the structure.	Physical and chemical structure	Appearance
Wicking is the ability of a fiber to transfer moisture along its surface.	Chemical and physical composition of outer surface	Makes fabrics comfortable