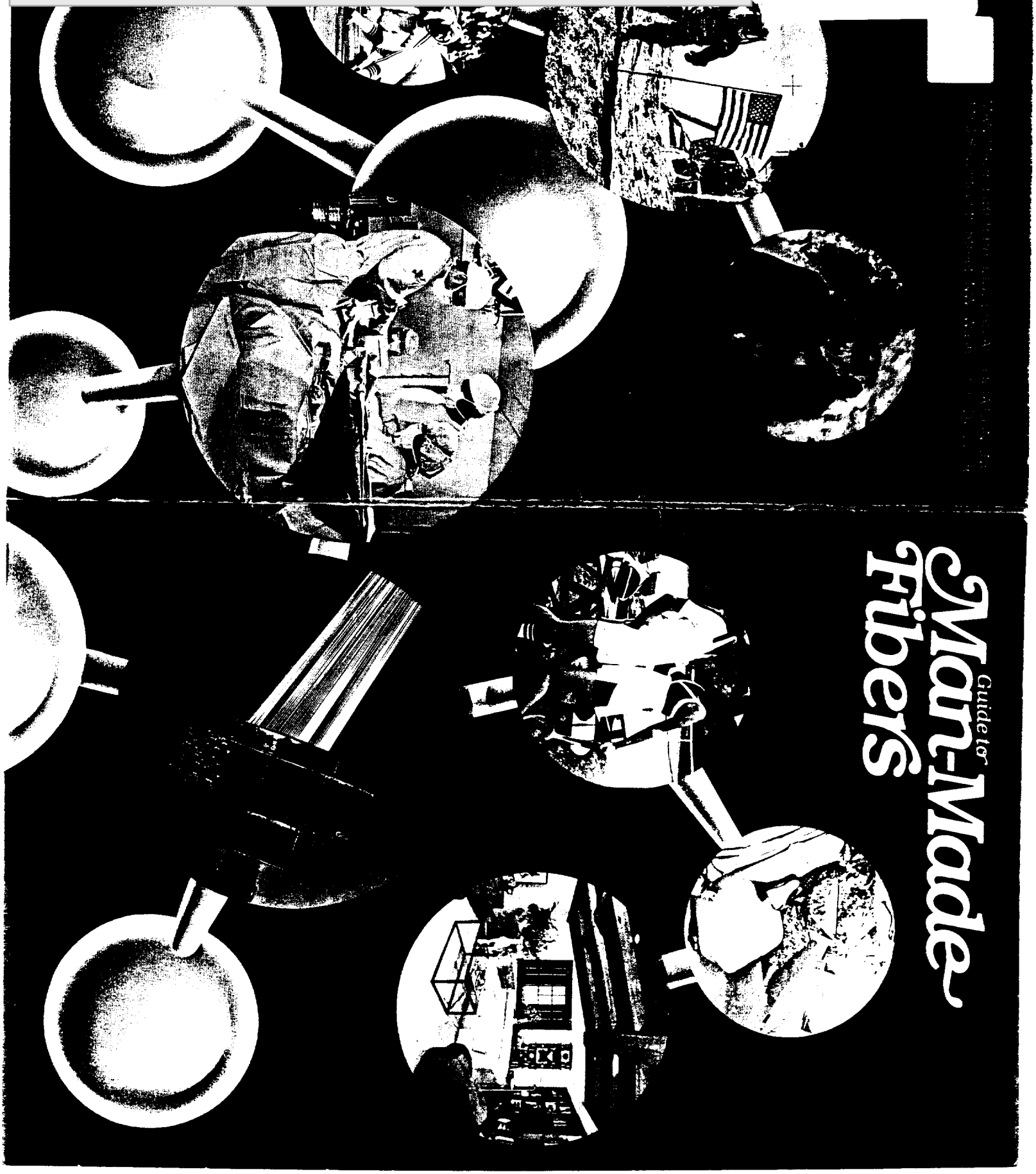


Guide to Man-Made Fibers

INDEX

The man-made fiber producing industry makes the fibers used in manufacturing improvec textile products.

This dynamic industry is a concerned and vital member of the business community, providing careers and opportunities for thousands of people. It provides more conveniences and greater variety in textile selections. It is a leader in developing new ideas and products.

Production of man-made fibers began around 1850 on an experimental basis. Rayon, the first commercially produced man-made fiber in the United States, was introduced in 1910. It was made from cellulose, the fibrous substance found in all forms of plant life. Back then, the cellulose for rayon came from cotton linters. Today, most rayon is made from purified wood pulp.

The first fiber produced completely from chemicals was nylon, with commercial production beginning in the United States during 1939. Nylon is now made from petrochemicals, which are derivatives of petroleum and natural gas. Since then, many new and totally different man-made fibers have been developed through the use of both cellulosic and chemical materials.

INDUSTRY GROWTH

Over the past 30 years, demand for man-made fiber products has increased rapidly and steadily.

In 1940, for example, the whole family of man-made fibers (which then consisted of rayon, acetate, nylon, vinyon and glass) accounted for only ten percent of the fibers used by American mills in their production of various textile items.

From the early 1940s through the 1950s, new generic categories of man-mades were commercially produced and, by 1960, mill consumption had doubled. Since the 1960s, usage of man-made fibers by U.S. textile mills has more than tripled.

Today, man-made fibers account for seventy percent of all fibers used by American mills in their production of textile products. The domestic man-made fiber industry produces approximately eight billion pounds of fiber a year and world production exceeds twenty billion pounds.

CONTRIBUTING FACTORS

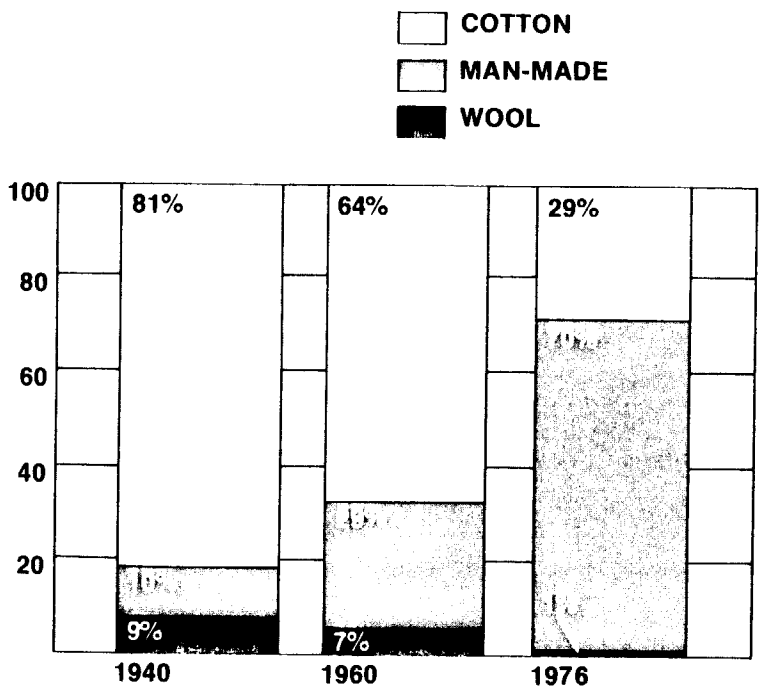
Many factors have contributed to this phenomenal growth. Certainly, research and development, production, marketing and management have all played major roles; but the public's acceptance of and demand for more products of man-made fibers is the real key.

These fibers are unique in that they can be carefully engineered and tailored to fit a specific need. They can be modified and improved to build desirable characteristics into a finished product. Today, it is not a question of having to select from a limited number of available fibers provided by nature, but rather using a fiber that specifically suits the total requirements of the product.

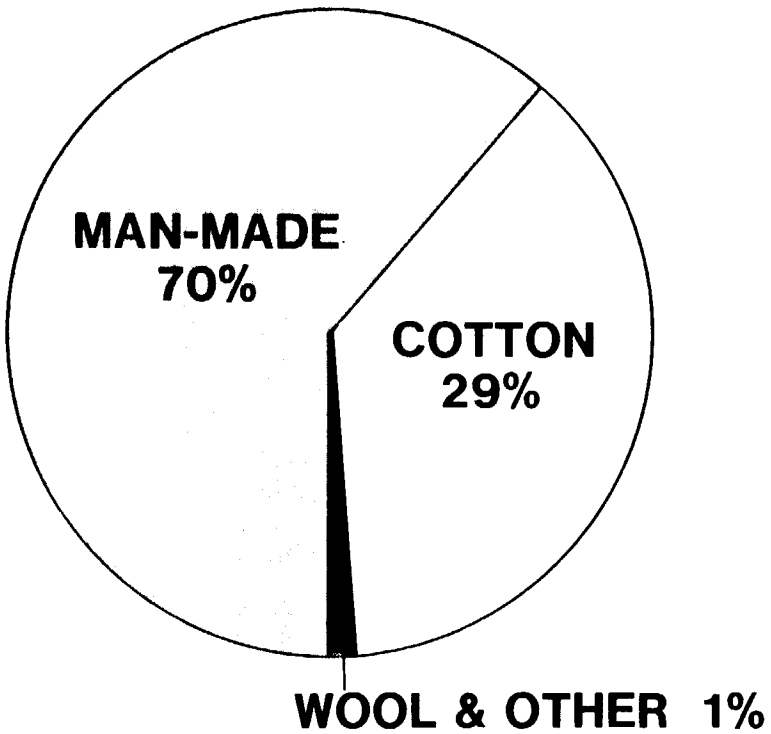
When a completely new fiber is developed, the U.S. Federal Trade Commission will assign it a generic name. In order to receive a generic name, the new fiber must be completely different in chemical composition from all other fibers and it must reflect significantly different properties of importance to the consumer.

U.S. Fiber Mill Consumption
(millions of pounds)

Polyester		3,330
Nylon/Aramid		2,095
Rayon		600
Acrylic/Modacrylic		560
Glass		678
Olefin		540
Acetate/Triacetate		262
Spandex/Saran/Vinyon		16
MAN-MADE	Total	8,081
COTTON		3,389
WOOL		145
		11,615



Current Percentages of Fibers Used In American-made Textile Products



GENERIC NAMES ARE LIKE FAMILY NAMES

The generic name of a man-made fiber is similar to a family name. Each generic fiber differs in name and personality, just as your family is different from your neighbor's. Each generic fiber has specific basic characteristics that perform needed functions in textile products, as the people of your community perform a variety of useful jobs. The Federal Trade Commission's definitions describe the broad, general chemical composition of a generic fiber. These definitions may be found on pages 22 and 23.

Today, there are twenty-one generic names for man-made fibers. Listed below are the current ones with the date of their first commercial U.S. production.

1910 - Rayon	1949 - Modacrylic
1924 - Acetate	1949 - Olefin
1930 - Rubber	1950 - Acrylic
1936 - Glass	1953 - Polyester
1939 - Nylon	1954 - Triacetate
1939 - Vinyon	1959 - Spandex
1941 - Saran	1967 - Aramid
1946 - Metallic	

Anidex, azlon, lastrile, novoloid, nytril and vinal also are generic names but are not currently produced in the United States.

VARIANTS ARE LIKE MEMBERS OF A FAMILY

It is possible to work within the basic generic composition and modify it, both chemically and physically, in order to produce a wide variety of different fibers called variants. These are members of a generic fiber family. Each will have different characteristics, yet they will conform to a basic Federal Trade Commission generic definition. Here again, as an example, all the members of your family have different personalities, yet they retain many of your family's basic features. Fiber variants are generally developed for a special purpose. They may be engineered to offer greater comfort, flame resistance or to reduce clinging in apparel. They may offer soil release or anti-static properties for carpet. They may have been developed to achieve greater whiteness or a special hand or luster. Variants also may be created for better blending with other fibers or to impart different dyeability properties to a textile material. There are endless possibilities for modifying a basic generic structure and producing new fibers with specific properties. The ability to engineer fibers with special built-in qualities is one of the truly unique aspects of the man-made fiber industry. This has resulted in many improved textile products for the ultimate consumer.

VARIANTS ALSO HAVE TRADEMARK NAMES

When a fiber manufacturer develops a new variant, it is usually given a name. This is called a trademark and it is owned and promoted by the fiber manufacturer who produced it. Some trademarks are better known than others, just as some generic names are more familiar to the public. It is important to clearly understand the difference between a trademark and a generic name. The basic trademarks for current generic classifications are listed on pages 24 through 26.

THE FIBER BASE

Most man-made fibers are formed by forcing a syrupy substance (about the consistency of honey) through the tiny holes of a device called a spinneret.

In their original state, the fiber-forming substances exist as solids and therefore must be first converted into a liquid state for extrusion. This is achieved by dissolving them in a solvent or melting them with heat. If they cannot be dissolved or melted directly, they must be chemically converted into soluble derivatives.

The basic substance for the three cellulosic fibers (acetate, rayon and triacetate) is cellulose which comes from purified wood pulp. It can be dissolved for extrusion into fibers. The substances used in the production of the noncellulosic fibers generally are melted or chemically converted into a liquid state.

DENIER

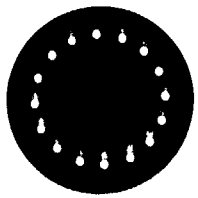
Unlike natural fibers, the man-mades can be extruded in different thicknesses. This is called denier. It is the industry's word for measuring the size of a continuous monofilament, a multifilament yarn or cut staple fiber.

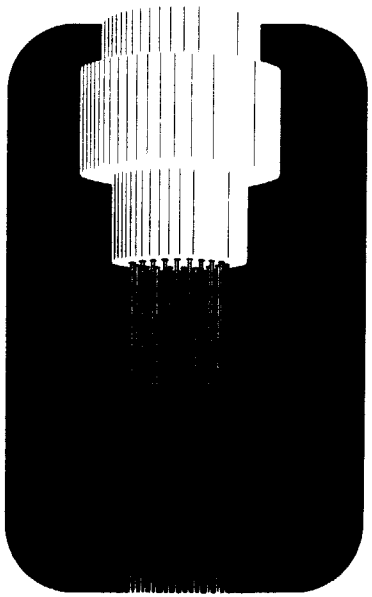
Fifteen (15)-denier monofilament is commonly used in pantyhose to achieve ultimate sheerness. Yarns of 840-denier are used in tires for trucks, automobiles, planes and other vehicles, giving greater strength. Incidentally, one pound of 15-denier yarn is 169 miles long, and one pound of 840-denier yarn in only three miles long.

THE SPINNERET

The spinneret, which is used in the production of all man-made fibers, is similar in principle to the shower head in your bathroom . . . liquid is forced through the holes. A spinneret can have from one to literally thousands of tiny holes and is generally made from very expensive corrosion-resistant metals.

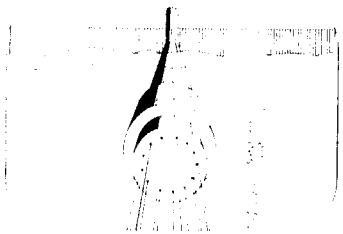
The filaments emerging from the holes in the spinneret are then hardened or solidified. The process of extrusion and hardening is called spinning, not to be confused with the textile operation of the same name. There are three methods of spinning man-made fibers: wet, dry and melt spinning. Some fibers may be produced by more than one method.





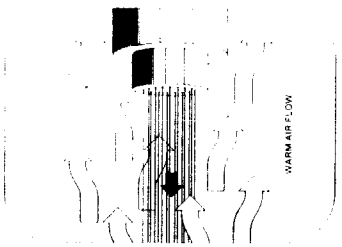
WET SPINNING

As the filaments emerge from the spinneret, they pass directly into a chemical bath where they are solidified or regenerated. Because of the bath, this process for making fibers is called wet spinning. Acrylic and rayon are produced by this type of process.



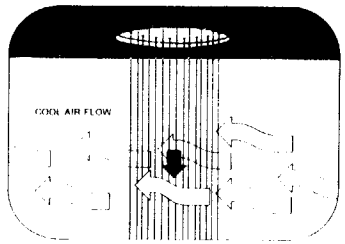
DRY SPINNING

When filaments coming from the spinneret are solidified by being dried in warm air, it is called dry spinning. This process is used in the production of acetate, acrylic, modacrylic, spandex, triacetate and vinyon.



MELT SPINNING

When the fiber-forming substance is melted for extrusion and hardened by cooling, the process is called melt spinning. Nylon, olefin, polyester, aramid and glass are produced by the melt spinning process.



STRETCHING AND ORIENTATION

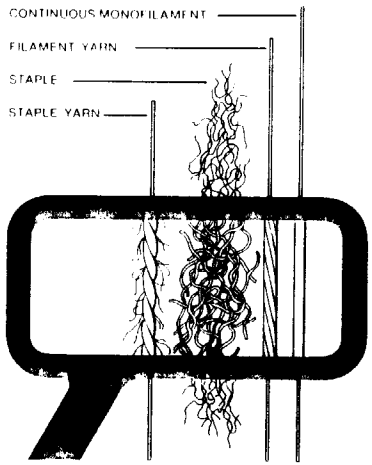
While the fibers are hardening, or after they have been hardened, the fibers are stretched. This reduces the fiber diameter, or denier, and causes the molecules in the fiber to arrange themselves into a more orderly pattern. In a given fiber type, the strength increases and the fiber's ability to stretch without breaking decreases as the pattern of the molecular arrangement becomes more orderly, or better oriented. A wide range of strength/stretch combinations may be produced in this way.

STAPLE FIBERS

Staple fibers are produced by first extruding many continuous filaments of specific denier from the spinneret in a large rope-like bundle called tow. A tow may often contain as many as 200,000 continuous filaments. These big bundles of fibers are crimped and then mechanically cut into the desired short staple lengths, usually one inch to four inches.

COMBINATION YARNS

Combination yarns can be formed by combining spun staple and filament yarns in numerous ways. These yarns give added strength. They are sometimes used as reinforcement in toes and heels of socks.



TEXTURED YARNS

Man-made fiber yarns can be textured by special machinery, giving them bulk, stretch and greater comfort qualities. The special texturing machines twist and manipulate the continuous filament yarns in such a way that the filaments no longer lie exactly parallel to one another. The increased space between the filaments allows the development of the special qualities mentioned above.

SPUN YARNS

The short fibers, or staple, may be twisted or spun, just as short lengths of natural fibers are spun. Staples of various lengths and denier are designed for use in various systems of spinning. The principal systems used are: (1) the cotton system, (2) the wool system, or (3) the worsted system. Some staple (usually crimped) is used without spinning—as filling in pillows, mattresses, sleeping bags and comforters. This is called fiberfill.

Yarns spun from staple are more irregular than filament yarns. The short ends of fibers, projecting from the yarn surface, produce a fuzzy effect. Spun yarns are also more bulky than filament yarns of the same weight. They are, therefore, more often used for porous, warm fabrics and for the creation of non-smooth surfaces for fabrics.

BLENDS

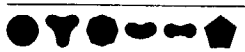
Man-made fibers can be blended with other fibers, either natural or man-made. When two or more types of staple fibers are blended, they bring together the best properties of each into a single yarn.

FILM FIBER

In some cases, a wide sheet of film is extruded and subsequently slit lengthwise into narrow continuous strips which, depending upon width, could be correctly described as monofilaments. These slit filaments are sometimes combined and used as multifilament yarns.

DIFFERENT FIBER SHAPES

Man-made fibers also can be extruded from the spinneret in different shapes (round, trilobal, pentagonal, octagonal and others) whereas natural fibers are available only in the form which nature provides them. Trilobal-shaped fibers reflect more light and give an attractive sparkle to textiles. Pentagonal-shaped fibers, when used in carpet, show less soil and dirt. Octagonal-shaped fibers offer glitter-free effects.



BICOMPONENT

With man-made fibers, the concept of blending or combining different materials can actually be taken all the way back to the extrusion process. Two different polymers can be extruded side by side in a single fiber coming from the spinneret to create a bicomponent. One of the polymers will have greater heat and/or moisture sensitivity than the other and will spiral during the finishing process, thus creating a fiber with greater bulk and comfort.

BICONSTITUENT

Two different polymers can be homogeneously mixed together during or prior to extrusion from the spinneret. This combines the characteristics from the two materials into a single fiber, called a biconstituent.

SPECIAL ADDITIVES

It also is possible to add certain additives to the polymers or the solution before it is extruded, thereby giving the finished fiber special characteristics, such as anti-static or flame retardancy.

SOLUTION DYEING

The process of adding the color to the polymer prior to extrusion is called solution dyeing and gives a high degree of colorfastness.

CROSS DYEING

Man-made fibers also can be cross dyed. This is a fascinating technique where cloth or carpet are woven, knitted or tufted from different types of the same generic fibers, then put through a dye bath. The different type fibers react to the different colors in the dye bath creating a special color. This enables a mill to offer its customers many different color combinations of a desired pattern.

Seventy percent of all woven, knitted and nonwoven fabrics used in American-made apparel, home furnishings and industrial products are man-made fibers. For example, 65% of all clothing contains man-made fibers; 99% of all carpet face fibers and 100% of all textile tire cord are made from these fibers. Why has the consumer taken so readily to this modern family of fibers, which includes polyester, nylon, rayon, acrylic, modacrylic, acetate, triacetate, olefin, spandex, saran, vinyon and others?

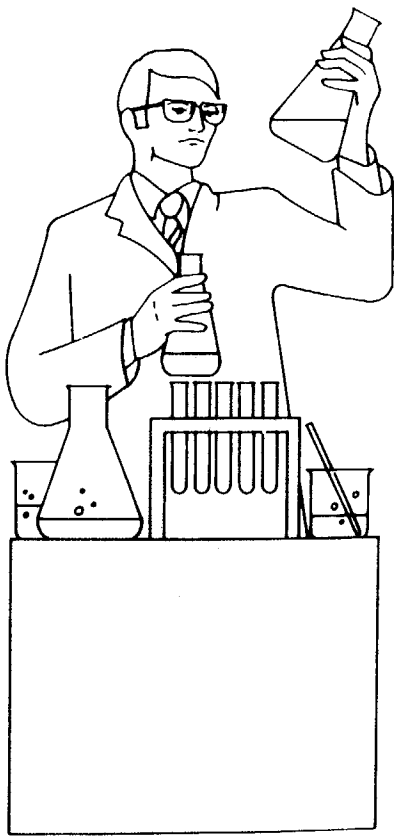
BETTER TEXTILE PRODUCTS

It is because man-made fiber products, whether in pure form or blended with other man-made or natural fibers, offer the buying public superior qualities in textile products. They offer easy care, which saves time and labor. They save energy through shorter drying cycles and less ironing. They offer durability by providing extra strength and longer life to the clothes we wear. They offer the greatest variety of textile and other products ever known.

Some can be made to absorb like cotton or look like fur or wool or silk. They can be sheer yet super strong. They can be made to stretch, to hold permanent pleats or be flame retardant. The amazing characteristics of these new fibers result in more practical and useful fabric for apparel, home furnishings and industrial applications.

ENGINEERED FOR SPECIAL USES

Through modern technology, the man-made fiber industry can engineer and tailor its fibers to the special needs of finished products. Man-made fibers can be extruded in different shapes for special purposes or in different thicknesses. They can be textured to give bulk, stretch and comfort or be cut into different lengths for blending with other fibers. Special additives can be mixed into basic fiber solutions to impart special qualities. New features can be built into man-made fibers, which result in more desirable merchandise, while natural fibers are only available in the form that nature provides them.



BLENDED DENIM

One recent example of how modern technology has been applied to produce a better product is in blended denim. The word "denim" is a definition of a *fabric* not a fiber.

For years, polyester or nylon has been blended with cotton in the production of denim cloth. However, these man-made fibers would not fade. Fading is a characteristic that consumers like in their denim apparel.

Through the joint efforts of man-made fiber producers and textile mills, new blends of polyester with cotton were developed that were dyeable with indigo and would fade in the same way as denim made from all cotton. The addition of the new polyester gives the consumer a bonus because the blended denim offers greater durability, tear resistance, neatness and controlled shrinkage.

UNIQUE USES

Most man-made fibers are designed for use in clothing, textiles for the home and industrial goods. Some, however, find their way into quite unusual applications.

Polyester, for example, is knitted or woven into fabrics for artificial blood vessels, arteries and innerlinings for some artificial hearts. Nonwoven fabrics of olefin, nylon or polyester are used in road construction as a textile layer between roadbed and surface pavement to prevent cracking and provide longer life for roads.

Aramid, a man-made fiber that is lighter and tougher than steel, is used to make finely woven layers of fabric for bullet-proof vests.

Huge, lightweight "skins" of man-made fiber fabric can be shaped into dramatic forms that provide coverings for stadiums, theaters, outdoor restaurants and other public gathering places. Coated nylon is used to line large reservoirs. Knitted or woven fabrics of man-made fibers can be coated and used as a major building material which is lighter and less expensive than metal.

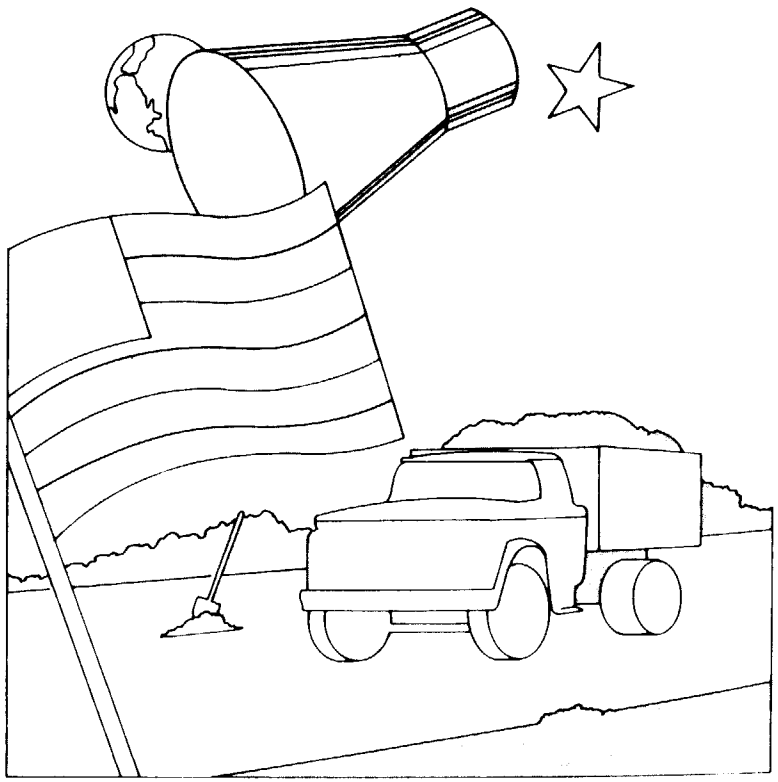
A nylon "whale" has been developed that can suck up a hundred thousand gallons of oil spill from the ocean. Carbon fibers are used to reinforce plastic in a host of products from spacecrafts to golf clubs. Modacrylic is used for false eyelashes, wigs and fake furs. The American flag on the moon is made of nylon.

FIBERS OF THE FUTURE

Today, the man-made fiber industry provides the great majority of the fiber needed by American textile mills—70%. Annual per capita fiber consumption has risen from 20 pounds in 1960 to 56 pounds currently and is predicted to reach 60 pounds by 1980.

The U.S. supply of raw cotton is now at its lowest point in 50 years and current production of U.S. wool is the lowest since 1930. Replacement of man-made fibers by cotton would require 30 million acres of land, more than doubling the present crop. To replace man-made fibers with wool would require a billion acres of grazing land, all the agricultural land of the United States.

Since neither of these approaches is economical nor practical, the increased demand for fibers in the future must come from the man-made fiber industry. This industry is tooling up its capacity to meet the growing needs of the American consumer for more and higher-quality textile products.



MAJOR USES/APPAREL

	ACETATE	ACRYLIC	ARAMID	METALLIC	MODACRYLIC	NYLON	OLEFIN	POLYESTER	RAYON	SARAN	SPANDEX	TRIACETATE	VINYON
Athletic uniforms						●		●		●			
Bathing suits						●	●			●			
Blouses	●	●		●		●	●	●			●		
Career apparel		●		●	●	●	●	●					
Children's wear		●			●	●	●	●			●		
Coats		●		●	●	●	●	●					
Dresses	●	●		●		●	●	●			●		
Fake furs		●			●	●	●	●					
Foundation garments	●					●				●			
Half-hose						●	●						
Hosiery				●		●	●			●			
Insulated garments			●			●	●						
Jackets		●		●		●	●	●		●	●		
Jeans (blends)							●	●					
Lingerie & underwear	●					●	●	●			●		
Linings	●					●	●	●					
Pile trims & linings		●			●	●	●						
Protective clothing			●			●	●						
Rainwear						●	●	●					
Robes	●	●		●		●	●	●			●		
Shirts (dress & sport)	●	●		●		●	●	●			●		
Ski & stretch apparel		●				●	●			●			
Skirts	●	●		●			●	●			●		
Slacks	●	●					●	●		●			
Socks		●				●	●			●			
Sportswear	●	●		●		●	●	●		●	●		
Suits		●		●		●	●	●					
Support & surgical hose						●				●			
Sweaters		●		●		●	●						
Ties						●	●	●					
Wigs & hairpieces				●									
Work garments		●	●			●	●	●					

Under MAJOR USES, we have checked only the fiber(s) that are most frequently used in the various products. Other fiber(s), which are not checked, may be used to a lesser degree in the manufacturing of these items.

	ACETATE	ACRYLIC	ARAMID	METALLIC	MODACRYLIC	NYLON	OLEFIN	POLYESTER	RAYON	SARAN	SPANDEX	TRIACETATE	VINYON
Air hoses			●			●		●	●				
Artificial turf						●							
Auto interiors				●				●		●			
Cigarette filters	●												
Conveyer belts			●			●		●					
Drapes for welders			●										
Hand knitting yarns		●		●			●						
Filters		●	●		●		●	●	●				
Fire hoses			●			●		●					
Laundry bags						●	●						
Luggage						●	●			●			
Medical products									●				
Military uses			●	●		●		●	●				
Nonwovens			●		●		●	●	●				●
Paint rollers					●			●					
Paint brushes						●							
Parachutes			●			●							
Racket strings			●			●							
Ropes and nets			●			●	●	●					
Sails			●			●		●					
Sandbags		●					●						
Seat belts			●			●		●					
Sleeping bags						●	●						
Stuffed toys					●				●				
Tarpaulins						●							
Teabags									●				●
Tents			●			●		●	●				
Threads			●			●	●	●					
Tire cord			●			●		●	●				
V-belts			●					●	●				

	ACETATE	ACRYLIC	ARAMID	METALLIC	MODACRYLIC	NYLON	OLEFIN	POLYESTER	RAYON	SARAN	SPANDEX	TRIACETATE	VINYON
Awnings		●			●		●	●		●			
Bedspreads	●					●		●	●			●	
Blankets		●			●			●					
Carpet		●			●	●	●	●					
Carpet backings							●						
Curtains					●	●		●	●				
Doormats (grass-like)							●						
Draperies	●	●		●	●	●		●	●	●		●	
Fiberfill	●	●						●					
Outdoor furniture						●	●			●			
Mattresses								●					
Mattress pads						●		●					
Pillowcases (blends)								●					
Scatter rugs		●		●	●	●		●					
Sheets (blends)								●	●				
Slipcovers				●		●	●	●	●				
Tablecloths				●		●		●	●				
Upholstery	●	●		●		●	●	●	●				

MAJOR CHARACTERISTICS

	ACETATE	ACRYLIC	ARAMID	METALLIC	MODACRYLIC	NYLON	OLEFIN	POLYESTER	RAYON	SARAN	SPANDEX	TRIACETATE	VINYON
Absorbent									●				
Colorfast		●		●		●	●	●	●	●		●	
Easy to dye	●		●			●			●			●	
Easy to launder		●	●	●		●	●	●	●		●	●	
Easy to iron			●			●		●	●			●	
Elastic						●					●		
Exceptional durability			●	●		●	●	●		●			
Flame resistant			●		●					●			
Good drapability	●		●			●			●			●	
Good shape retention		●			●	●		●			●	●	
Quick drying		●	●		●	●	●	●			●	●	
Resilient		●	●		●	●		●					
Resistant to:													
abrasion			●			●	●	●					
chemicals		●	●		●	●	●	●		●			
moth	●	●	●	●	●	●	●	●	●	●	●	●	●
mildew	●	●	●	●	●	●	●	●		●	●	●	●
oil/grease		●	●			●					●		
pilling	●								●			●	
stretching			●					●					
soil			●				●						
shrinking		●	●	●		●		●		●		●	
weather		●		●	●		●	●	●	●			
Soft	●	●			●				●				
Strong			●			●	●	●		●			
Warm		●			●	●		●					
Wide color range	●	●			●	●		●	●			●	
Wrinkle resistant		●						●			●	●	

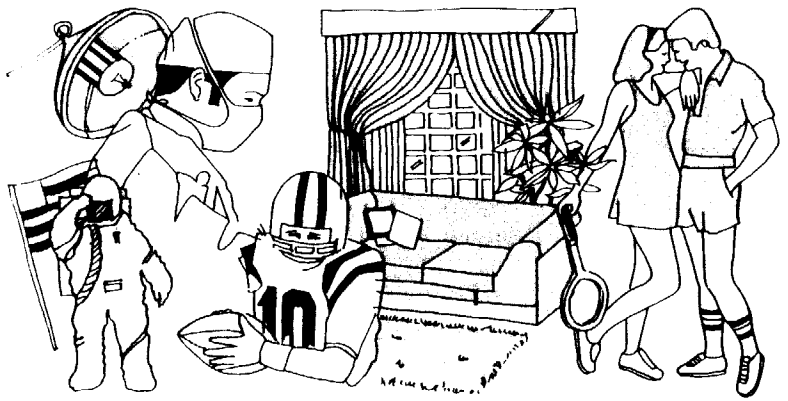
Under MAJOR CHARACTERISTICS, we have checked only the most outstanding properties of the generic fiber. Variations of other fibers, which are not checked, may offer some of these characteristics.

25 MAJOR USES OF MAN-MADE FIBERS

With Approximate Annual Poundage Used (in millions of pounds)

TOTAL APPAREL	3,100
TOTAL HOME FURNISHINGS	2,324
TOTAL INDUSTRIAL AND OTHER PRODUCTS	1,837
Carpet and Rugs	1,591
Tires	510
Retail Piece Goods	410
Reinforced Plastics	371
Drapery and Upholstery	317
Blouses (w/g)*	269
Dress and Sport Shirts (m/b)*	210
Sheets and Bedding	196
Slacks (w/g)	175
Career Apparel	165
Underwear, Nightwear, Foundations (w)	153
Dresses (w/g)	143
Hosiery	138
Slacks (m/b)	130
Medical, Surgical, Sanitary	129
Rope, Cordage, Fishline	128
Lining	115
Blankets	103
Craft and Handiwork Yarns	95
Pile Fabrics	95
Sweaters	78
Coated and Protective Fabrics	77
Suits (m/b)	70
Underwear, Nightwear (m)	61
Robes and Loungewear	60

*(w/g) women's & girls' (m/b) men's & boys'



This Guide is made available to help you understand and follow the brief care instructions found on permanent labels on garments. Be sure to read all care instructions completely!

MACHINE WASHABLE

WHEN LABEL READS:	IT MEANS:
Machine wash	Wash, bleach, dry and press by any customary method including commercial laundering and dry-cleaning
Home launder only	Same as above but do not use commercial laundering
No chlorine bleach	Do not use chlorine bleach. Oxygen bleach may be used
No bleach	Do not use any type of bleach
Cold wash **Cold rinse**	Use cold water from tap or cold washing machine setting
Warm wash **Warm rinse**	Use warm water or warm washing machine setting
Hot wash	Use hot water or hot washing machine setting
No spin	Remove wash load before final machine spin cycle
Delicate cycle **Gentle cycle**	Use appropriate machine setting; otherwise wash by hand
Durable press cycle **Permanent press cycle**	Use appropriate machine setting; otherwise use warm wash, cold rinse and short spin cycle
Hand wash separately	Hand wash alone or with like colors

NON-MACHINE WASHABLE

Hand wash	Launder only by hand in lukewarm (hand comfortable) water. May be bleached. May be dry-cleaned
Hand wash only	Same as above, but do not dry-clean
Hand wash separately	Hand wash alone or with like colors
No bleach	Do not use bleach
Damp wipe	Surface clean with damp cloth or sponge

HOME DRYING

WHEN LABEL READS:	IT MEANS:
Tumble dry	Dry in tumble dryer at specified setting—high, medium, low or no heat
Tumble dry **Remove promptly**	Same as above, but in absence of cool-down cycle remove at once when tumbling stops
Drip dry	Hang wet and allow to dry with hand shaping only
Line dry	Hang damp and allow to dry
No wring **No twist**	Hang dry, drip dry or dry flat only Handle to prevent wrinkles and distortion
Dry flat	Lay garment on flat surface
Block to dry	Maintain original size and shape while drying

IRONING OR PRESSING

Cool iron	Set iron at lowest setting
Warm iron	Set iron at medium setting
Hot iron	Set iron at hot setting
Do not iron	Do not iron or press with heat
Steam iron	Iron or press with steam
Iron damp	Dampen garment before ironing

MISCELLANEOUS

Dry-clean only	Garment should be dry-cleaned only, including self-service
Professionally dry-clean only	Do not use self-service dry-cleaning
No dry-clean	Use recommended care instructions. No dry-cleaning materials to be used

This care Guide was produced by the Consumer Affairs Committee, American Apparel Manufacturers Association and is based on the Voluntary Guide of the Textile Industry Advisory Committee for Consumer Interests.

SOME PHYSICAL PROPERTIES OF MAN-MADE FIBERS

(Standard laboratory conditions for fiber tests: 70 F. and 65% relative humidity)

Fiber	Breaking Tenacity† (Grams per denier) Standard	Wet	Specific Gravity††	Standard Moisture Regain (%)‡	Effects of Heat
ACETATE (filament and staple)	1.2 to 1.5	0.8 to 1.2	1.32	6.0	Sticks at 350° to 375°F. (177° to 191°C) Softens at 400° to 445°F. (205° to 230°C) Melts at 500°F. (260°C) Burns relatively slowly.
ACRYLIC (filament and staple)	2.0 to 3.5	1.8 to 3.3	1.14 to 1.19	1.3 to 2.5	Sticks at 450° to 497°F. (232° to 258°C), depending on type.
ARAMID					
regular tenacity filament	4.8	4.8	1.38	5	Decomposes above 800°F. (427°C)
high tenacity filament	22	22	1.44	2.7 to 7	Decomposes above 900°F. (482°C)
staple	3.0 to 4.5	3.0 to 4.5	1.38	5	Decomposes above 800°F. (427°C)
MODACRYLIC (filament and staple)	2.0 to 3.5	2.0 to 3.5	1.30 to 1.37	0.4 to 4.0	Will not support combustion. Shrinks at 250°F. (121°C) Stiffens at temperatures over 300°F. (149°C)
NYLON					
nylon 66 (regular tenacity filament)	3.0 to 6.0	2.6 to 5.4	1.14	4.0 to 4.5	Sticks at 445°F. (229°) Melts at about 500°F. (260°C)
nylon 66 (high tenacity filament)	6.0 to 9.5	5.0 to 8.0	1.14	4.0 to 4.5	Same as above.
nylon 66 (staple)	3.5 to 7.2	3.2 to 6.5	1.14	4.0 to 4.5	Melts at 414° to 428°F. (212° to 220°C)
nylon 6 (filament)	6.0 to 9.5	5.0 to 8.0	1.14	4.5	Melts at 414° to 428°F. (212° to 220°C)
nylon 6 (staple)	2.5	2.0	1.14	4.5	Melts at 414° to 428°F. (212° to 220°C)
OLEFIN (polypropylene) (filament and staple)	4.8 to 7.0	4.8 to 7.0	.91	—	Melts at 325° to 335°F. (163° to 168°C)
POLYESTER					
regular tenacity filament	4.0 to 5.0	4.0 to 5.0	1.22 or 1.38*	0.4 or 0.8*	Melts at 480° to 550°F. (249° to 288°C)
high tenacity filament	6.3 to 9.5	6.2 to 9.4	1.22 or 1.38*	0.4 or 0.8*	Melts at 480° to 550°F. (249° to 288°C)
regular tenacity staple	2.5 to 5.0	2.5 to 5.0	1.22 or 1.38*	0.4 or 0.8*	Melts at 480° to 550°F. (249° to 288°C)
high tenacity staple	5.0 to 6.5	5.0 to 6.4	1.22 or 1.38*	0.4 or 0.8*	Melts at 480° to 550°F. (249° to 288°C)
RAYON (filament and staple)					
regular tenacity	0.73 to 2.6	0.7 to 1.8	1.50 to 1.53	13	Does not melt. Decomposes at 350° to 464°F. (177° to 240°C) Burns readily.
medium tenacity	2.4 to 3.2	1.2 to 1.9	1.50 to 1.53	13	
high tenacity	3.0 to 6.0	1.9 to 4.6	1.50 to 1.53	13	
high wet modulus	2.5 to 5.5	1.8 to 4.0	1.50 to 1.53	13	
SPANDEX (filament)	0.6 to 0.9	0.6 to 0.9	1.20 to 1.21	.75 to 1.3	Degrades slowly at temperatures over 300°F. (149°C) Melts at 446° to 518°F. (230° to 270°C)
TRIACETATE (filament and staple)	1.2 to 1.4	0.8 to 1.0	1.3	3.2	Before heat treatment, sticks at 350° to 375°F. (177° to 191°C) After treatment, above 464°F. (240°C) Melts as 575°F. (302°C)

* Depending on type.

† BREAKING TENACITY: The stress at which a fiber breaks, expressed in terms of grams per denier.

†† SPECIFIC GRAVITY: The ratio of the weight of a given volume of fiber to an equal volume of water.

‡ STANDARD MOISTURE REGAIN: The moisture regain of a fiber (expressed as a percentage of the moisture-free weight) at 70 F. and 65% relative humidity.

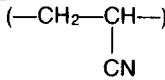
NOTE: Data given in ranges may fluctuate according to introduction of fiber modifications or additions and deletions of fiber types.

Federal Trade Commission Rules and Regulations under the Textile Products Identification Act.

Pursuant to the provisions of Section 7(c) of the Act, the following generic names for manufactured fibers, together with their respective definitions, are hereby established:

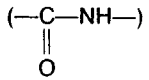
acetate—a manufactured fiber in which the fiber-forming substance is cellulose acetate. Where not less than 92% of the hydroxyl groups are acetylated, the term **triacetate** may be used as a generic description of the fiber.

acrylic—a manufactured fiber in which the fiber-forming substance is any long chain synthetic polymer composed of at least 85% by weight of acrylonitrile units



anidex—a manufactured fiber in which the fiber-forming substance is any long chain synthetic polymer composed of at least 50% by weight of one or more esters of a monohydric alcohol and acrylic acid.

aramid—a manufactured fiber in which the fiber-forming substance is a long-chain synthetic polyamide in which at least 85% of the amide



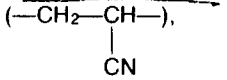
linkages are attached directly to two aromatic rings.

azlon—a manufactured fiber in which the fiber-forming substance is composed of any regenerated naturally occurring proteins.

glass—a manufactured fiber in which the fiber-forming substance is glass.

metallic—a manufactured fiber composed of metal, plastic-coated metal, metal-coated plastic, or a core completely covered by metal.

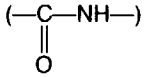
modacrylic—a manufactured fiber in which the fiber-forming substance is any long chain synthetic polymer composed of less than 85% but at least 35% by weight of acrylonitrile units,



except fibers qualifying under subparagraph (2) of paragraph (j) (rubber) of this section and fibers qualifying under paragraph (q) (glass) of this section.

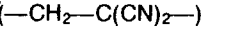
novoloid—a manufactured fiber containing at least 85% by weight of a cross-linked novolac.

nylon—a manufactured fiber in which the fiber-forming substance is a long-chain synthetic polyamide in which less than 85% of the amide



linkages are attached directly to two aromatic rings.

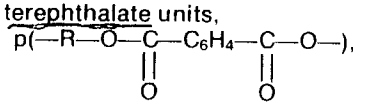
nytril—a manufactured fiber containing at least 85% of a long chain polymer of vinylidene dinitrile



where the vinylidene dinitrile content is no less than every other unit in the polymer chain.

olefin—a manufactured fiber in which the fiber-forming substance is any long chain synthetic polymer composed of at least 85% by weight of ethylene, propylene, or other olefin units, except amorphous (non-crystalline) polyolefins qualifying under category (1) of Paragraph (j) (rubber) of Rule 7.

polyester—a manufactured fiber in which the fiber-forming substance is any long chain synthetic polymer composed of at least 85% by weight of an ester of a substituted aromatic carboxylic acid, including but not restricted to substituted terephthalate units,

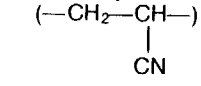


and parasubstituted hydroxybenzoate units,

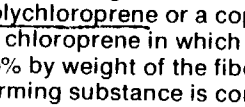
(As amended September 12, 1973.)

rayon—a manufactured fiber composed of regenerated cellulose, as well as manufactured fibers composed of regenerated cellulose in which substituents have replaced not more than 15% of the hydrogens of the hydroxyl groups.

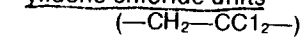
rubber—a manufactured fiber in which the fiber-forming substance is comprised of natural or synthetic rubber, including the following categories: (1) a manufactured fiber in which the fiber-forming substance is a hydrocarbon such as natural rubber, polyisoprene, polybutadiene, copolymers of dienes and hydrocarbons, or amorphous (non-crystalline) polyolefins, (2) a manufactured fiber in which the fiber-forming substance is a copolymer of acrylonitrile and a diene (such as butadiene) composed of not more than 50% but at least 10% by weight of acrylonitrile units.



The term **lastrile** may be used as a generic description for fibers falling within this category, (3) a manufactured fiber in which the fiber-forming substance is a polychloroprene or a copolymer of chloroprene in which at least 35% by weight of the fiber-forming substance is composed of chloroprene units.

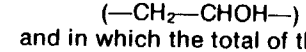


saran—a manufactured fiber in which the fiber-forming substance is any long chain synthetic polymer composed of at least 80% by weight of vinylidene chloride units



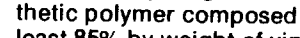
spandex—a manufactured fiber in which the fiber-forming substance is a long chain synthetic polymer comprised of at least 85% of a segmented polyurethane.

vinal—a manufactured fiber in which the fiber-forming substance is any long chain synthetic polymer composed of at least 50% by weight of vinyl alcohol units



and in which the total of the vinyl alcohol units and any one or more of the various acetal units is at least 85% by weight of the fiber.

vinyon—a manufactured fiber in which the fiber-forming substance is any long chain synthetic polymer composed of at least 85% by weight of vinyl chloride units.



(Listed below are the basic fiber trademarks registered by the Member Companies of the Man-Made Fiber Producers Association which are currently active. The list does not include service marks, guarantees, warranties or variations of the basic fiber trademark.)

Trademark	Generic Name	Member Company
Acrilan	acrylic, modacrylic	Monsanto Textiles Company
Anso	nylon	Allied Chemical Corp., Fibers Div.
Antron	nylon	E.I. du Pont de Nemours & Co., Inc.
Ariloft	acetate	Eastman Kodak Company Tennessee Eastman Co. Division
Arnel	triacetate	Celanese Fibers Marketing Co. Celanese Corp.
Avlin	polyester	Avtex Fibers Inc.
Avril	rayon (high wet modulus)	Avtex Fibers Inc.
Beau-Grip	rayon	Beaunit Corporation
Beaunit Nylon	nylon	Beaunit Corporation
Bi-Loft	acrylic	Monsanto Textiles Company
Blue "C"	nylon, polyester	Monsanto Textiles Company
Cadon	nylon	Monsanto Textiles Company
Cantrece	nylon	E.I. du Pont de Nemours & Co., Inc.
Caprolan	nylon, polyester	Allied Chemical Corp., Fibers Div.
Celanese	nylon, acetate	Celanese Fibers Marketing Co., Celanese Corp.
Chromspun	acetate	Eastman Kodak Company Tennessee Eastman Co. Division
Coloray	rayon	Courtaulds North America Inc.
Cordura	nylon	E.I. du Pont de Nemours & Co., Inc.
Courtaulds Nylon	nylon	Courtaulds North America Inc.
Crepeset	nylon	American Enka Company
Creslan	acrylic	American Cyanamid Company
Cumuloft	nylon	Monsanto Textiles Company
Dacron	polyester	E.I. du Pont de Nemours & Co., Inc.
Elura	modacrylic	Monsanto Textiles Company
Encron	polyester	American Enka Company
Enkaloft	nylon	American Enka Company
Enkalure	nylon	American Enka Company
Enkasheer	nylon	American Enka Company
Enkrome	rayon	American Enka Company
Estron	acetate	Eastman Kodak Company Tennessee Eastman Co. Division
Fibro	rayon	Courtaulds North America Inc.
Fina	acrylic	Monsanto Textiles Company
Fortrel	polyester	Fiber Industries Inc., Marketed by Celanese Fibers Marketing Co., a Division of Celanese Corp.
Herculon	olefin	Hercules Inc., Fibers Division
Hollofil	polyester	E.I. du Pont de Nemours & Co., Inc.
Kevlar	aramid	E.I. du Pont de Nemours & Co., Inc.
Kodel	polyester	Eastman Kodak Company Tennessee Eastman Co. Division
Lanese	acetate, polyester	Celanese Fibers Marketing Co. Celanese Corp.
Loftura	acetate	Eastman Kodak Company Tennessee Eastman Co. Division
Lurex	metallic	Dow Badische Company
Lycra	spandex	E.I. du Pont de Nemours & Co., Inc.
Marvess	olefin	Phillips Fibers Corp., Subsidiary of Phillips Petroleum Co.
Monvelle	biconstituent nylon/spandex	Monsanto Textiles Company
Multisheer	nylon	American Enka Company
Nomex	aramid	E.I. du Pont de Nemours & Co., Inc.
Orlon	acrylic	E.I. du Pont de Nemours & Co., Inc.
Polyloom	olefin	Chevron Chemical Co., Fibers Div.
Qiana	nylon	E.I. du Pont de Nemours & Co., Inc.
Quintess	polyester	Phillips Fibers Corp., Subsidiary of Phillips Petroleum Co.
SEF	modacrylic	Monsanto Textiles Company
Shantura	polyester	Rohm and Haas Co., Fibers Div.
Shareen	nylon	Courtaulds North America Inc.
Spectran	polyester	Monsanto Textiles Company
Strialine	polyester	American Enka Company
Teflon	fluorocarbon	E.I. du Pont de Nemours & Co., Inc.
Textura	polyester	Rohm and Haas Co., Fibers Div.
Trevira	polyester	Hoechst Fibers Industries
Twisloc	polyester	Monsanto Textiles Company
Ulstron	nylon	Monsanto Textiles Company
Ultron	nylon	Monsanto Textiles Company
Vecana	nylon	Chevron Chemical Company
Vectra	olefin	Vectra Corp., Subsidiary of Chevron Chemical Company
Verel	modacrylic	Eastman Kodak Company Tennessee Eastman Co. Division
Vycron	polyester	Beaunit Corporation
Xena	rayon (high wet modulus)	Beaunit Corporation
X-Static	nylon, metallic	Rohm and Haas Co., Fibers Div.
Zantrel	rayon (high wet modulus)	American Enka Company
Zeflon	nylon	Dow Badische Company
Zefran	acrylic, nylon, polyester	Dow Badische Company

TRADEMARKS OF FORMED FIBERS

Bidim	polyester, spunbonded	Monsanto Textiles Company
Cerex	nylon, spunbonded	Monsanto Textiles Company
Duon	olefin, needlebonded polyester, needlebonded	Phillips Fibers Corp., Subsidiary of Phillips Petroleum Co.
Enkamat	nylon, meltbonded	American Enka Company
Mirafi	thermally bonded nylon/polypropylene	Fibers Industries, Inc. Marketed by Celanese Fibers Marketing Co., Div. of Celanese Corp.
Petromat	olefin, needlebonded	Phillips Fibers Corp., Subsidiary of Phillips Petroleum Co.
Reemay	polyester, spunbonded	E.I. du Pont de Nemours & Co., Inc.
Sontara	spunlaced	E.I. du Pont de Nemours & Co., Inc.
Supac	olefin, needlebonded	Phillips Fibers Corp., Subsidiary of Phillips Petroleum Co.
Typar	polypropylene, spunbonded	E.I. du Pont de Nemours & Co., Inc.
Tyvek	olefin, spunbonded	E.I. du Pont de Nemours & Co., Inc.

TRADEMARKS OF MEMBER COMPANIES NOT CLASSIFIED AS "FIBER TRADEMARKS"

This list of trademarks indicates trademarks used by Members which do not come within the Federal Trade Commission definition of "fiber trademark" but which may be used, from time to time, to identify the source of certain man-made fibers or other products of the company.

Trademark	Member Company
ACT	Allied Chemical Corporation. Marketed by Specialty Chemicals Division
ADORATION	E.I. du Pont de Nemours & Co., Inc.
ANGELREST	Fiber Industries, Inc., Marketed by Celanese Fibers Marketing Company, A Division of Celanese Corporation
ANTELETTE	Fiber Industries, Inc., Marketed by Celanese Fibers Marketing Company, A Division of Celanese Corporation
ASTROTURF	Monsanto Textiles Company
BEAUNIT	Beaunit Corporation
BYTRECE	E.I. du Pont de Nemours & Co., Inc.
CELABOND	Celanese Fibers Marketing Co., Celanese Corporation
CELAIRE	Celanese Fibers Marketing Co., Celanese Corporation
CELANESE	Celanese Fibers Marketing Co., Celanese Corporation
CELANNA	Celanese Fibers Marketing Co., Celanese Corporation
CELARA	Celanese Fibers Marketing Co., Celanese Corporation
CELARA KNIT	Celanese Fibers Marketing Co., Celanese Corporation
CELASPUN	Celanese Fibers Marketing Co., Celanese Corporation
CHEMSTRAND	Monsanto Textiles Company
COURTAULDS	Courtaulds North America Inc.
CUPROFINO	Beaunit Corporation
DU PONT	E.I. du Pont de Nemours & Co., Inc.
DYE I	Monsanto Textiles Company
EASTMAN	Eastman Kodak Company, Tennessee Eastman Company Division
ELURA	Monsanto Textiles Company
ENKA	American Enka Company
FMC	Avtex Fibers Inc.
HERCULES	Hercules Incorporated
HYTEN	E.I. du Pont de Nemours & Co., Inc.
LOWLAND	American Enka Company
RESISTAT	Dow Badische Company
SERENE	Fiber Industries, Inc., Marketed by Celanese Fibers Marketing Company, A Division of Celanese Corporation
SONTARA	E.I. du Pont de Nemours & Co., Inc.
SPUNIZE	Allied Chemical Corporation, Fibers Division
SUPERBA	Fiber Industries, Inc., Marketed by Celanese Fibers Marketing Company, A Division of Celanese Corporation
TASLAN	E.I. du Pont de Nemours & Co., Inc.
WEAR-DATED	Monsanto Textiles Company
ZEFSTAT	Dow Badische Company
ZEFWEAR	Dow Badische Company

INTERPLAY—THE STORY OF MAN-MADE FIBERS

A filmstrip kit containing a 140-frame color filmstrip, 20-minute phonograph record or cassette tape, instructor's script/lesson plan, 50 student booklets, latest edition of the Man-Made Fiber Fact Book and classroom wall chart. Kit may be ordered without record or cassette.

COST: With record or cassette—$10
Without record or cassette—$8

MAN-MADE FIBER FACT BOOK

A book giving statistical data on the man-made fiber industry, characteristics and uses of the different fibers, trademarks and educational materials from the Association and its Members.

COST: $1 per copy; 10% discount on ten or more copies.

WALL CHART

A colorful, 20" x 26" poster providing a quick reference to generic names of man-made fibers and uses, trademarks of Member Companies and information on the industry.

FLOW CHART

A chart depicting the processing of textile products, from the fiber producer to the end-use consumer. Outlines such areas as spinning, converting, knitting, weaving and manufacturing of end-use products.

FOCUS ON MAN-MADE FIBERS

A newsletter published periodically and dealing with subjects of key interest affecting the public and industry.

To order any of the materials listed or additional copies of the GUIDE TO MAN-MADE FIBERS, write:

Education Department
Man-Made Fiber Producers Association, Inc.
1150 Seventeenth Street, NW
Washington, DC 20036

Additional educational materials are available from the Member Companies listed on the following page.

MEMBERS OF THE MAN-MADE FIBER PRODUCERS ASSOCIATION, INC.

Allied Chemical Corporation
Fibers Division
1411 Broadway
New York, New York 10018

American Cyanamid Company
Fibers Division
Berdan Avenue
Wayne, New Jersey 07470

American Enka Company
A Part of Akzona, Inc.
Enka, North Carolina 28728

Avtex Fibers Inc.
Fiber Division
1185 Avenue of the Americas
New York, New York 10036

Beaunit Corporation
261 Madison Avenue
New York, New York 10016

Celanese Corporation
Celanese Fibers Marketing Company
1211 Avenue of the Americas
New York, New York 10036

Chevron Chemical Company
7300 Ritchie Highway
Glen Burnie, Maryland 21061

Courtaulds North America Inc.
104 West 40th Street
New York, New York 10018

Dow Badische Company
Williamsburg, Virginia 23185

E. I. du Pont de Nemours & Company, Inc.
Textile Fibers Department
Wilmington, Delaware 19898

Eastman Chemical Products, Inc.
Kingsport, Tennessee 37662

Hercules Incorporated
Fibers Division
910 Market Street
Wilmington, Delaware 19899

Hoechst Fibers Industries
1515 Broadway at Astor Plaza
New York, New York 10036

Monsanto Textiles Company
800 North Lindbergh Boulevard
St. Louis, Missouri 63166

Phillips Fibers Corporation
Subsidiary of
Phillips Petroleum Company
Box 66
Greenville, South Carolina
29602

Rohm and Haas Company
Fibers Division
Independence Mall West
Philadelphia, Pennsylvania
19105