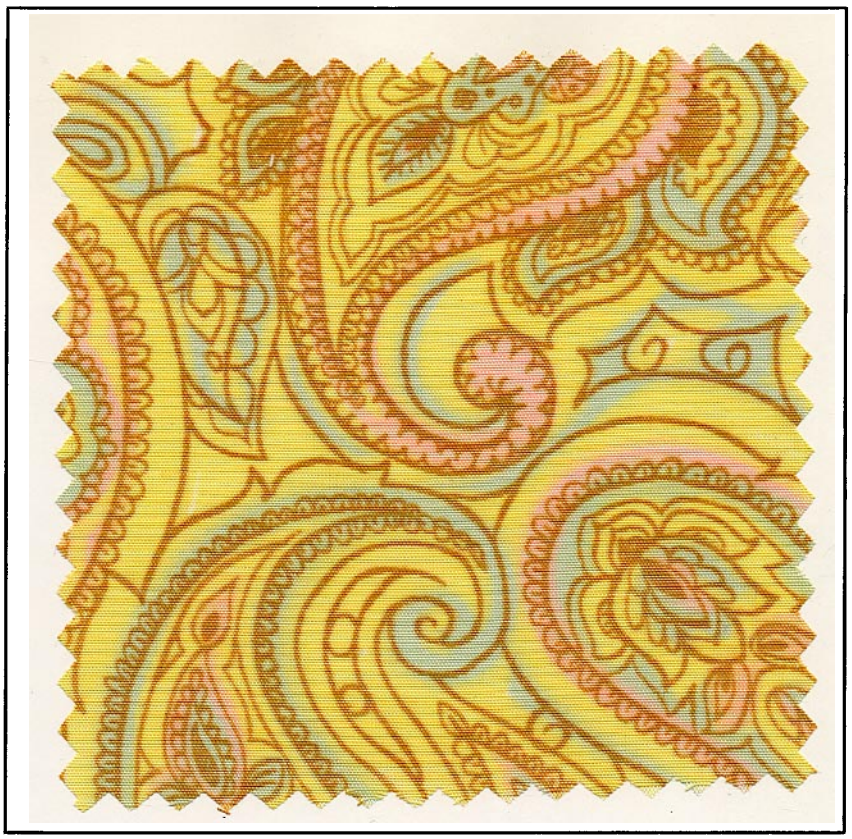


Fortrel polyester Batiste, Celanese Corporation of America—Stein and Fishman

FORTREL

Definition: Fortrel is a polyester fiber made by Celanese Fiber Company, a division of the Celanese Corporation of America. Imperial Chemical Industries developed the first polyester type yarn called Terylene, on whose patent Dacron was produced in the United States by the DuPont Company.

Advantages:

- Fortrel is a very strong fiber and fabrics made of it meet performance specifications.
- It is resilient, wrinkle-resistant and crease-resistant.
- It has the capacity for blending with any of the natural or synthetic fibers.
- Fortrel fabrics can be drycleaned and wetcleaned.
- It must be pressed with an iron at the lowest setting (225° - 250°F.), on the wrong side, or with a press cloth on the right side.

Disadvantages:

- White fabrics tend to discolor from static attracted air-borne soil. This may be controlled with special finishes.
- Some of the anti-static finishes are removed in drycleaning and wetcleaning.

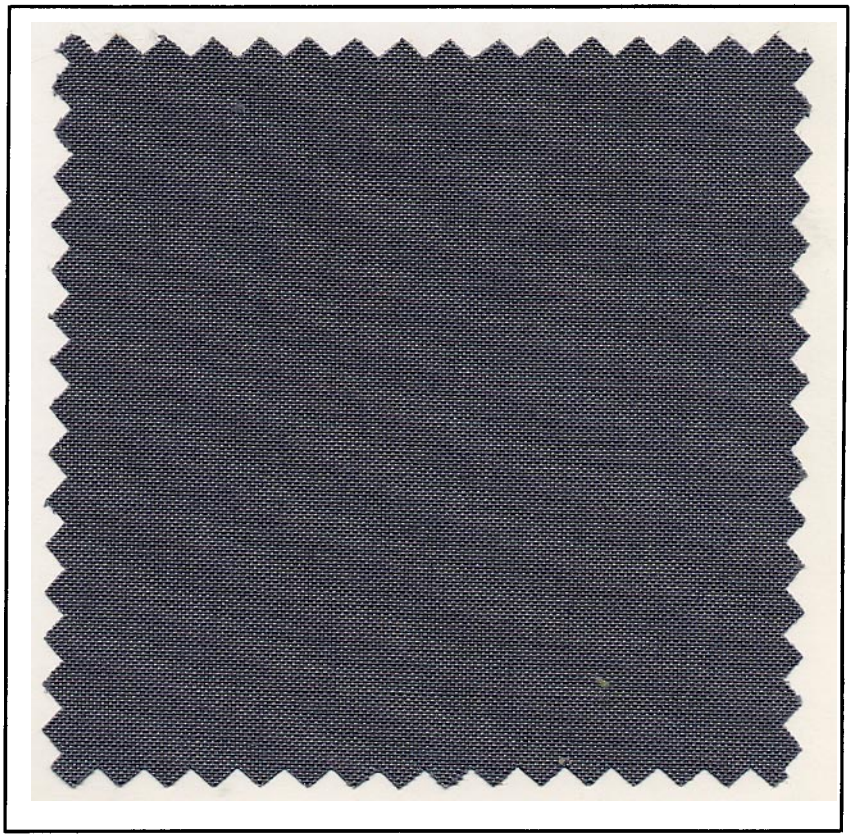
KODEL

Definition: Kodel is classified as a polyester fiber. However, it is different from any other polyester both in chemical composition and internal molecular structure. It is a trade-mark name of Eastman Chemical Products, Inc.

Advantages:

- Kodel can be blended with any other fiber because of its softness and flexibility. It gives anesthetic hand.
- It is strong, resilient and possesses good recovery power.
- It is relatively insensitive to water. It resists weathering.
- Kodel imparts loft and bulk without weight; it is resistant to pilling.
- It is wrinkle-resistant and has good crease retention.
- Kodel fabrics can be drycleaned and wetcleaned.
- It can be pressed with a hand iron at the setting for wool. This is higher than the pressing temperature for most synthetic fibers. If blended with fibers that are heat-sensitive, the temperature setting safe for the blended fiber must be used.

100% Kodel—Eastman Chemical Products, Inc.



Disadvantages:

- Kodel is resistant to bleaches.
- Kodel swells slightly in perchlorethylene. This may result in slight shrinkage.
- The problem of frosting and color staining has been overcome.

Shirting—50% Vycron, 50% cotton—Beaunit Corp.

VYCRON

Definition: Vycron is a polyester fiber extruded from polymerized Vitel, a new resin developed by the chemical division of Goodyear Rubber Company. It differs in chemical composition and structure from other polyester fibers. Vycron is a trade-mark name of Beaunit Mills Fiber Division. Vycron is presently sold only in blended fabrics.

Advantages:

- Vycron has a high strength and good resistance to abrasion.
- It has good resistance to pilling and to weathering.
- Good colorfastness can be achieved if dyes are properly selected and applied.
- Vycron can be blended with other fibers. Fabrics may be made dimensionally stable by proper heat setting and thermosetting resins or by compressive shrinkage.
- Vycron is not affected by common acids and alkalies.
- Vycron can be drycleaned and wetcleaned.

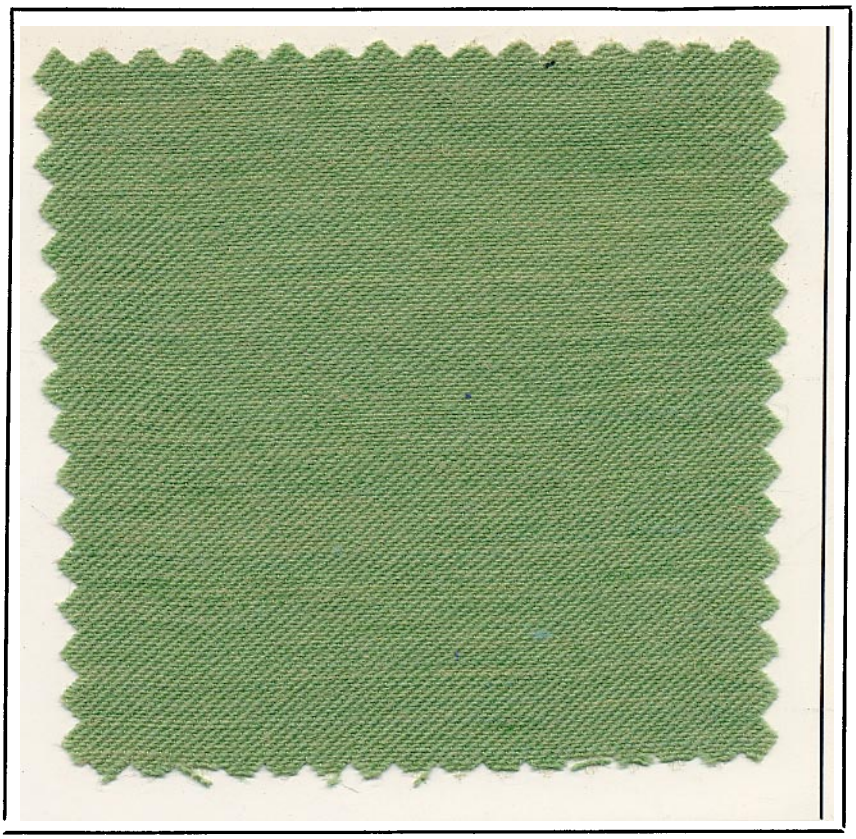
- It has good heat resistance. Fabrics may be ironed safely at temperatures as high as 350°F. (Melting point, 455°F.).

Disadvantages:

- Some Vycron fabrics pill readily.
- Vycron is heat-sensitive. Cigarette embers will cause a hole in a Vycron fabric.

8. Saran

As defined by the Federal Trade Commission, Saran is 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.



100% Saran—Warp: filament; Filling: spun

SARAN

Definition: Saran is a synthetic fiber. It is a copolymer of vinylidene chloride. It is a trade-mark name of the Dow Chemical Company.

Advantages:

- Saran is extremely resistant to acidic and alkaline substances.
- It has a natural resistance to staining.
- Saran is flame-resistant; it does not support combustion.
- Saran is weather-resistant.
- Spun Saran looks and feels like wool.
- Saran fibers are solution-dyed. Therefore, they possess good colorfastness to light. However, this also limits the range in colors.
- Saran fabrics have good abrasion resistance.
- Saran is resistant to moths; mildew.
- Saran is resistant to moisture, a desirable property for curtains, drapery and upholstery fabrics.
- In some constructions, Saran fabrics provide sound control; heat control; sun glare control.

- Saran fabrics may be wetcleaned or drycleaned depending on the construction of the item. Temperature should not exceed 100°F.
- Chlorine-type bleach may be used on white fabrics, but temperature of bath should not exceed 100°F.

Disadvantages:

- Wrinkles are difficult to remove. This fabric cannot be pressed as the steam required for finishing will cause excessive shrinkage of the fabric. Temperatures over 160°F. will cause shrinkage and sticking; higher temperatures will cause fabric damage.
- Ultraviolet light turns Saran brown.
- Saran yarns shrink when drycleaned in perchlorethylene. This is said to be due to molecular reorientation caused by slight absorption of the solvent by the fiber.

ROVANA

Definition: Rovana is a flat mono-filament made of vinylidene chloride copolymer. It is distinguished from Saran by its physical cross-section. Saran monofilament has a round cross-section. Rovana resembles a folded flat, tape-like ribbon. The width of the yarn is many times its thickness. It is a trademark name of the Dow Chemical Company.

Advantages:

- Rovana's flat physical characteristic gives it greater strength, greater covering power.
- A fabric containing 65% or more Rovana possesses good flame resistance.
- Rovana is weather, rot and mildew-resistant.
- It can be combined with other fibers to make a wide variety of textures, weights and fabric constructions.
- Rovana can be drycleaned in petroleum solvent. It can be wetcleaned. It should not be dried at temperatures above 140°F.

Avalon. Warp: Verel and Rayon; Filling: Rovana

Disadvantages:

- If Rovana yarns are not stabilized they swell in perchlorethylene. This may result in shrinkage.
- If Rovana fabrics are not stabilized, they may shrink with steam finishing.
- If Rovana fabrics are pressed with a hand iron, the iron should be on rayon setting (225°F.). The iron will stick to the fabric at a higher setting, stiffen if temperature gets above 250°F.

VELON

Definition: Velon is classed as a synthetic fiber. It is made of a plastic known as vinylidene chloride. It is a trade-mark name of the Firestone Plastics Company.

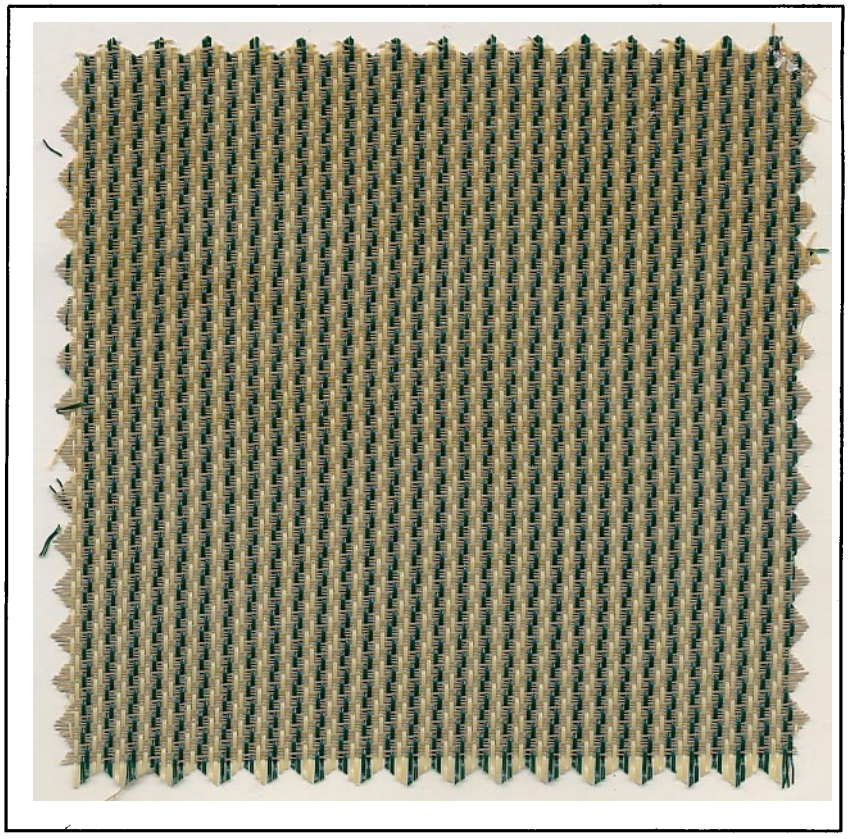
Advantages:

- Velon is very resistant to acidic and alkaline substances.
- Velon fabrics resist soiling; resist staining.
- Velon is non-absorbent, hence dries quickly.
- Velon is moth-resistant; mildew-resistant.
- Velon fabrics are weather-resistant; flame-resistant.
- Velon is best laundered or wetcleaned.
- Do not use ammonia-type bleach on Velon curtains. Velon curtains should not be starched.

Disadvantages:

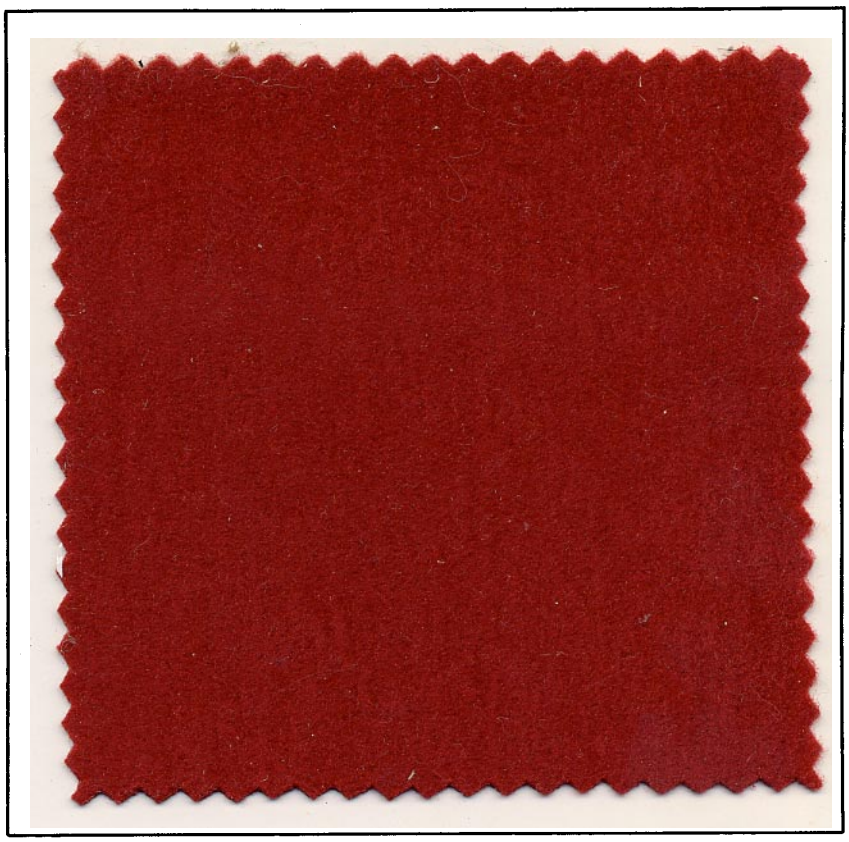
- Mechanical action may cause permanent wrinkling of Velon fabrics.
- Velon fabrics are very heat-sensitive. Temperatures over 160°F. will cause shrinkage and sticking; higher temperatures will cause fabric damage.

100% Velon



9. Vinyon

As defined by the Federal Trade Commission, vinyon is 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.



70% Nylon, 30% Rhovyl-Vinyon, Suede-faced knit—John J. Ryan & Sons

RHOVYL

Definition: Vinyon is no longer manufactured in the United States for wearing apparel fabrics. A similar fiber Rhovyl, a polyvinyl, is manufactured in France. John J. Ryan & Sons, Inc., is the sole distributor of Societé Rhovyl's fiber and filament yarns in the United States. A similar fiber, Movil, is imported from Italy; Kurchalon from Japan.

Advantages:

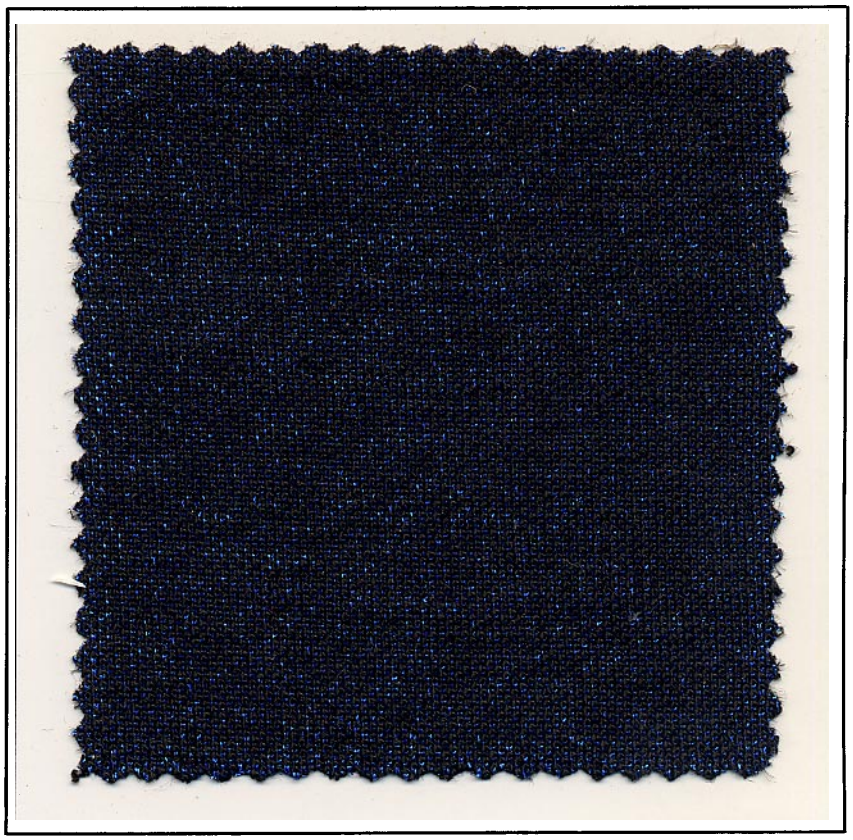
- Since the fiber is thermoplastic at temperatures above 212°F., fabrics made from it can be heat stamped, embossed and permanently pleated.
- The thermoplastic property permits bonding, sealing, fusing, shaping and moulding.
- The fiber is non-flammable. It will melt at 365°F.
- It is sunlight, mildew, weather-resistant.
- The fiber may be solution-dyed for good colorfastness.
- It can be blended with other fibers. Fabrics possess good insulating properties.
- Because of its heat shrinking ability, it is used to an advantage in producing three dimensional effects, two-height pile fabrics, sculptured, suede and bulk-type fabrics.

Disadvantages:

- Rhovyl is made in two basic forms—Rhovyl T, a non-shrink fiber that is dimensionally stable, and Rhovyl 55. The latter can shrink up to 55% at 212°F.
- Regardless of trade name, if the heat-sensitive fiber is not labeled, items that are tumble dried and steam finished shrink excessively.
- Rhovyl fabrics made of yarns that are not relaxed by heat when manufactured may shrink when the fabric is finished or pressed.

10. Olefin

As defined by the Federal Trade Commission, olefin is 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.



40% Polypropylene, 40% Rayon, 20% Metallic.

POLYPROPYLENE

Definition: Polypropylene fibers are obtained from propylene gas which is polymerized and transformed into a fiber. In the United States, Montecantini's Meraklon fiber is sold exclusively through the Chemore Corporation.

Advantages:

- Polypropylene is the lightest fiber (*specific gravity, 0.91*) in existence. This results in high covering power and exceptionally light-weight fabrics.
- It is said to produce fabrics that are four times as warm as any other fiber.
- It has resistance to acids, alkalies, micro-organisms, insects.
- It has high tensile strength, abrasion resistance, snag resistance, wrinkle resistance, weather resistance.
- Polypropylene does not absorb water readily. It is quick drying and will float in water.
- It is used to make a wide range of household, industrial, automobile upholstery, and outside furnitude fabrics, and wearing apparel.
- It can be blended with any natural or synthetic fiber.

Disadvantages:

- Polypropylene is heat-sensitive. It shrinks easily when heat is applied.
- Polypropylene takes dyes with difficulty. Dyeability has been improved but continues to present problems.

GERFIL

Gerfil is a filament extruded from polypropylene and is used to make hosiery at the present time. Plans are to use Gerfil for lingerie, sportswear, outerwear, children's wear and men's wear fabrics. Gerfil is made by G. F. Chemical Company.

POLYETHYLENE

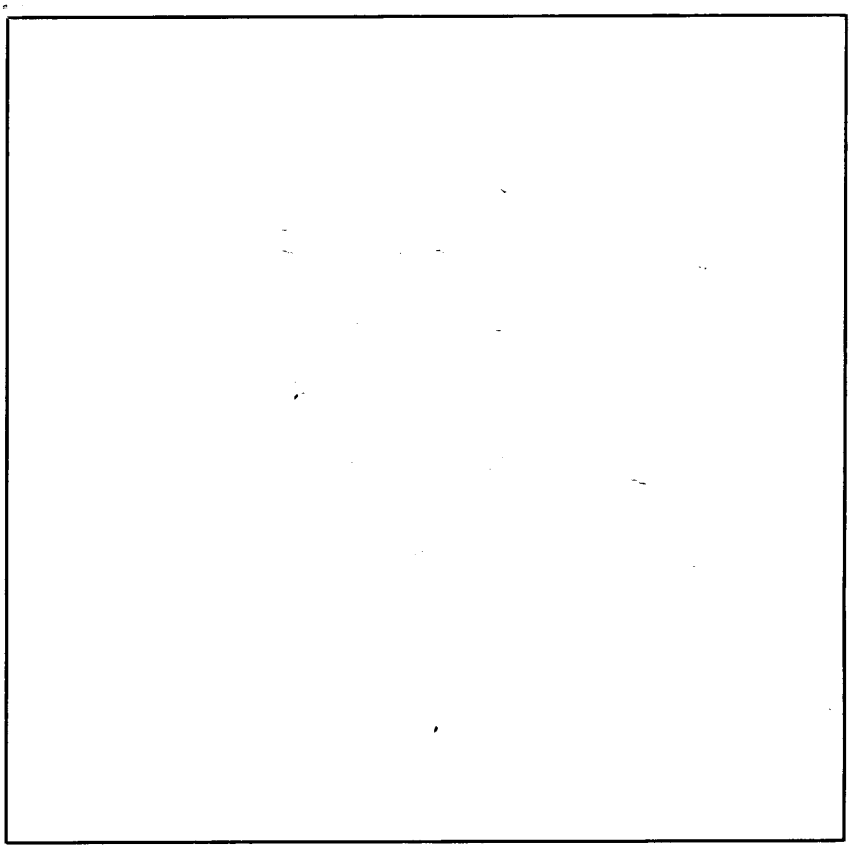
Definition: Polyethylene is an olefin fiber. It is sold under several brand names. It may also be made into a film and used as a lining fabric.

Advantages:

- Polyethylene is resistant to acids and alkalies.
- It is mildew and weather-resistant.
- It does not absorb water readily; it dries quickly.
- It can be made in heavy denier and used to make three-dimensional effects in upholstery and slipcover fabrics.
- It may be made in fine denier yarns for apparel fabrics.
- It holds promise in the non-woven fabrics.

Disadvantages:

- Fabrics should be drycleaned in petroleum solvent. The fiber swells in perchlorethylene. Shrinkage results.
- The fabric should be dried at temperatures below 120°F. Shrinkage results at higher temperatures.



- Polyethylene is heat-sensitive. It shrinks easily when heat is applied.
- Polythylene has low tensile strength; low abrasion resistance.
- It is light-sensitive; it is difficult to dye.
- Mineral and vegetable oils are absorbed readily and cause the fiber to swell.

OLEFIN FIBERS

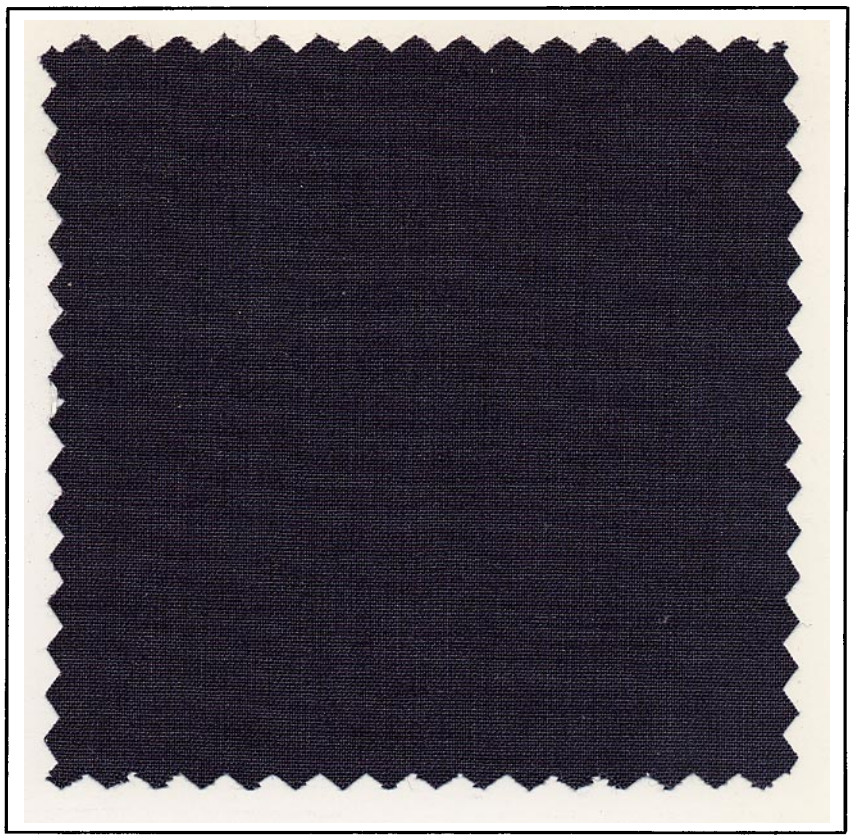
TRADE-MARK NAMES	MANUFACTURERS
DLP	Dawbarn
Velon LP	Firestone Plastics
Boltathene (bol-ta-thené)	General Tire and Rubber, Bolta Products Division
Herculon	Hercules Powder Company
Reevon	Reeves Brothers
Reevon-Isotactic	Reeves Brothers
Rayalene	U. S. Rubber
Trilok	U. S. Rubber
Gerfil	G. F. Chemical Company
Vectra	National Plastic Products

11. Spandex

As defined by the Federal Trade Commission, spandex is a manufactured fiber in which the fiber-forming substance is long chain synthetic polymer comprised of at least 85% of a segmented polyurethane.

Many methods can be utilized for the production of spandex.

(1) From gun-type urethane through normal rubber processing procedures.
(2) By dry-spinning from a solvent solution of a polyurethane into a heated chamber.
(3) By wet-spinning a urethane polymer into a coagulating bath.
(4) By melt-spinning a solid urethane polymer.



89% Nylon, 11% Spandex (Lycra)

LYCRA

Definition: Lycra is a trade-mark name of DuPont's elastomer yarn. Multifilament bundles are joined together to form a monofilament yarn. The yarn can be used uncovered or it can be covered with textile yarns. A new fine yarn made by "core spinning" technique has a center filament of bare Lycra in 40 to 70 deniers and a single or double spun fiber such as wool, cotton, Orlon, Dacron. The yarns are used in the filling direction of woven fabrics such as dresswear, sportswear, suiting and shirting fabrics.

Advantages:

- Lycra compares with natural rubber in its high degree of stretch.
- It has the ability to spring back to its original shape or stretch. After repeated stretching, it shows only a small change in length.
- It possesses a high tensile strength.
- Lycra may be used to make a wide range of fabrics, from light sheer fabrics with good strength to heavier weight fabrics for good control.
- Lycra resists deterioration due to oxidation. It is also said to be resistant to perspiration, cosmetic oils and lotions.
- Fabrics made of Lycra may be drycleaned and wetcleaned, depending on garment construction.

Disadvantages:

- Early fabrics had a tendency to discolor quickly with wear. Some improvement has been made with this problem. New finishes have been developed to check yellowing of either the bare or covered Lycra fabrics.
- Avoid the use of chlorine bleaches. Chlorine causes degradation.
- Avoid high temperatures in laundering or wetcleaning.

VYRENE

Definition: Vyrene is a trade-mark name for U. S. Rubber Company's elastomer yarn. Multifilament Lycra appears to be a single continuous thread. It is covered with various other fibers, depending on the end use fabric to be made.

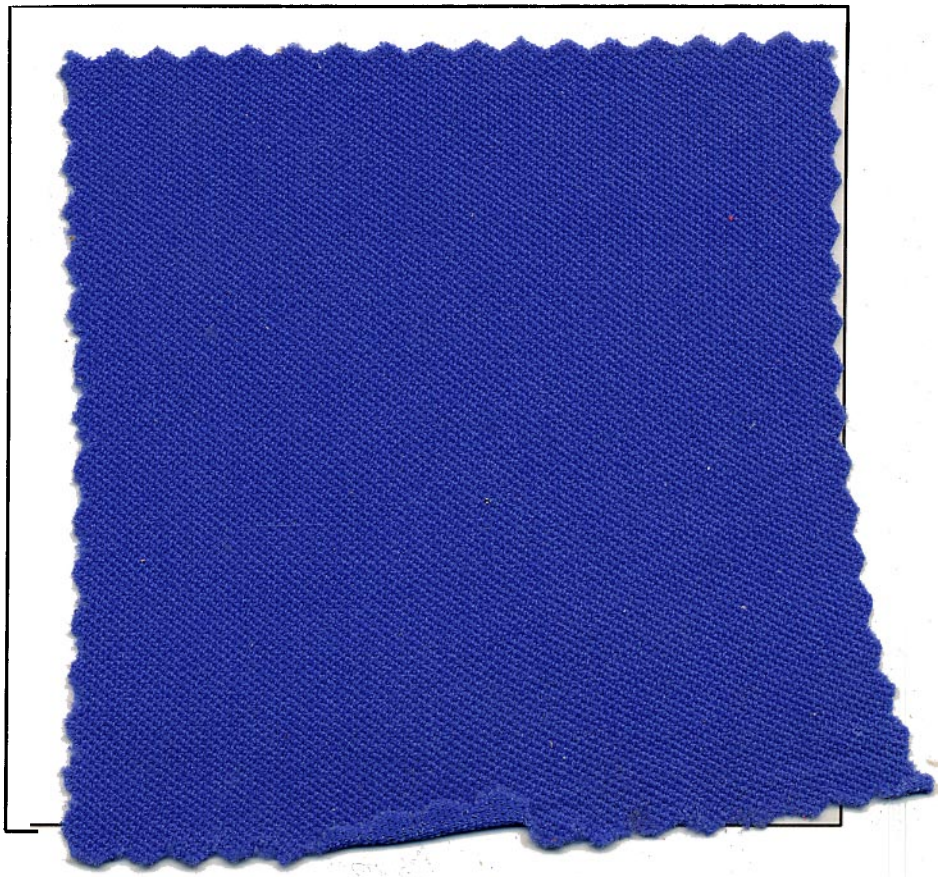
Advantages:

- Its strength compares with natural rubber. It has a high degree of stretch.
- After stretching it springs back to original shape or set. It shows only a slight change in length after repeated stretching.
- It possesses high tensile strength.
- It is resistant to chafing under strain.
- Vyrene resists deterioration due to oxidation.

Disadvantages:

- Early fabrics had a tendency to discolor with wear. Some improvement has been made with this problem.

88% Nylon, 12% Vyrene.



- Avoid the use of chlorine bleaches. Chlorine causes degradation.
- Avoid high temperatures in laundering or wetcleaning.

SPANDEX

TRADE-MARK NAMES	MANUFACTURER
Not named	American Cyanamid
Blue C	Chemstrand Company
Duraspun, Stretch-ever (fabric)	DuPont Company
Lycra	DuPont Company
Spandelle	Firestone Synthetic Fibers Co.
Glospan	Globe Manufacturing Co.
Not named	International Stretch Products
Curel	Reeves Brothers
Vyrene	U. S. Rubber Co.

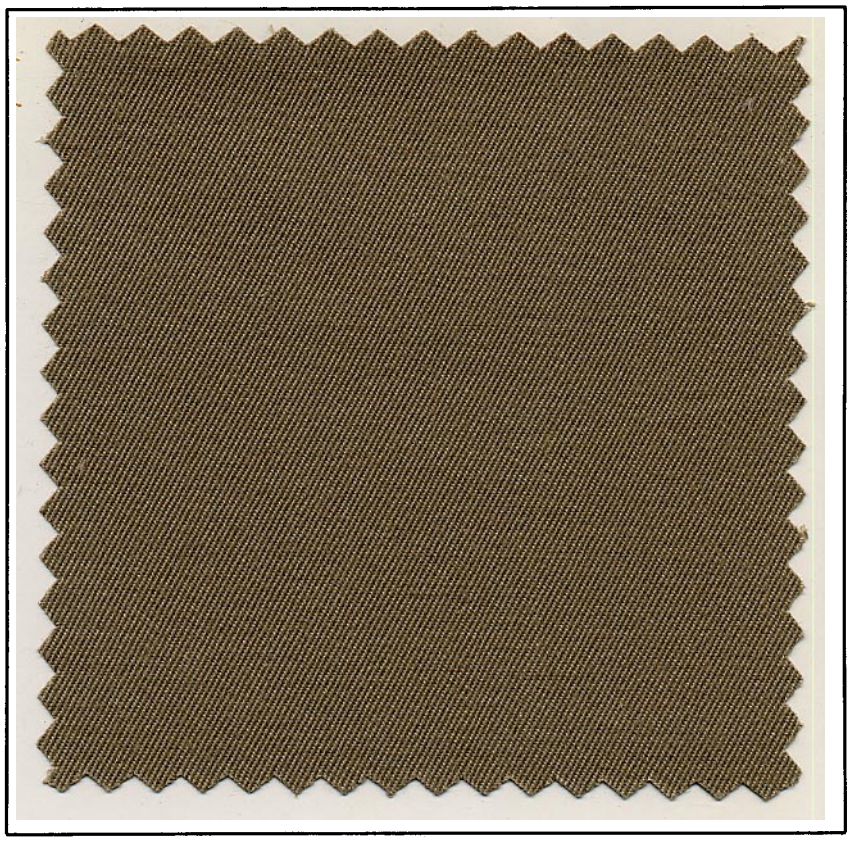
OROFIL

Orofil is a synthetic elastomer, not a spandex. It has not been classified generically by the Federal Trade Commission. Orofil is a trade-mark name of Rohm and Haas Company. It is a monofilament with a rectangular cross-section. The natural color is white. Fluorescent dyes are incorporated in the fiber to improve the appearance of the fabric. It will accept dyes readily. Although not primarily made for outerwear, tests revealed that it is drycleanable in both petroleum solvent and perchlorethylene. One woolen fabric manufacturer has made a stretch fabric utilizing Orofil. It is now considered to have a very promising future in outerwear fabrics.

Fabric differs from attached.

12. Vinal

As defined by the Federal Trade Commission, vinal is 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.



Vinal and Cotton Blend.

AIR CO VINAL

Definition: Vinylon is the common international designation for fibers of polyvinyl alcohol. Air Reduction Company is the United States licensee on the process of Kurashiki Rayon of Japan for making polyvinyl alcohol resin and Vinylon fiber. Air Reduction has the right to license other companies here. The firm has adopted the generic term Vinal to identify Vinylon. The yarn and fabric is not made in the United States at this writing. Fabrics are imported from Japan.

Advantages:

- Vinylon may be combined with both natural and synthetic fibers.
- It has high tensile strength and tear strength.
- Vinylon is a good compromise between hydrophobic and hydrophilic fibers. This contributes a comfort factor in wearing apparel fabrics.
- It contributes a pleasing hand to knit constructions.
- Vinylon is resistant to abrasion, chemicals at moderate temperatures and to micro-biological attack.
- It is sun and weather-resistant.

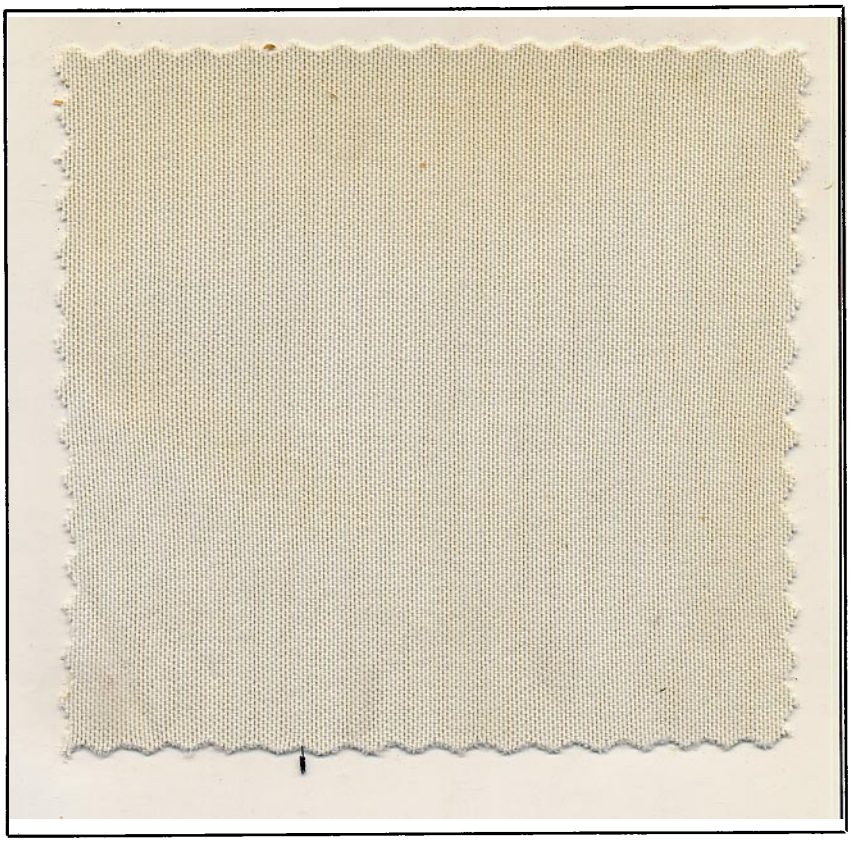
- Vinylon can be dyed readily with dyes that are resistant to sunlight.
- It can be bleached with hypochlorite or chlorite bleaches; hydrogen peroxide under controlled conditions.

Disadvantages:

- Vinylon is softened to some extent by water at high temperatures.
- Vinylon fabric should not be put under any strain while wet.
- Vinylon fabrics should not be pressed while damp or wet. This may cause stiffness and glazing.

13. Rubber

As defined by the Federal Trade Commission, rubber is a manufactured fiber in which the fiber-forming substance is comprised of natural or synthetic rubber.



NATURAL RUBBER

Definition: Natural rubber is classed as an elastomer. Rubber is made by two methods: by cutting and by extrusion through a spinneret.

There are two generally accepted methods used in cutting rubber into ribbon:

(1) A calendered sheet is vulcanized and then slit into tapes. The tapes are then slit into thread and formed immediately into ribbon by pressure rolls.

(2) A calendered sheet is cut into 48″ squares and individual sheets are placed one on top of another until a specific number is reached. This "pile" is then cut into doughnut form and cured in a press. The cured disc is then cut into a ribbon by causing the disc to rotate while a rotating circular blade cuts through it to form the ribbon.

Extruded rubber thread is obtained by compounding latex with necessary ingredients, then forcing it through a spinneret into an acidic bath. The thread is then washed, dried, taken up on a spool and cured.

Rubber may be used alone or covered with a textile yarn.

Advantages:

- Rubber can be adapted to a variety of uses, such as waistbands, webbing, stretch fabrics. It may also be used for decorative effects.

- It can be made in very light to medium and heavy-weight fabrics.
- Rubber has high strength and exceptional holding power.
- Fabrics containing rubber should be wetcleaned or laundered, dried at low temperatures.

Disadvantages:

- Natural rubber should not be drycleaned. It is affected by drycleaning solvents.
- Rubber can discolor with exposure to perspiration. It may also discolor with wetcleaning or laundering.
- Flexing may cause breaking and loss of elasticity.
- Swelling and flexing of the rubber yarn covered with a textile yarn can result in the segmenting of the rubber core yarn. This causes the loss of elasticity and elongation.
- If any copper or brass comes in contact with the rubber during manufacture, a chemical reaction occurs that causes deterioration of the rubber.

RUBBER FIBERS

TRADE-MARK NAMES	MANUFACTURER
A. Natural rubbers—Cut	
Ribbon	Easthampton Rubber
Carr Fulflex	Carr Rubber
Rheeflex	Rhee Elastic
B. Natural rubbers—Extruded	
Lactron	U. S. Rubber Co.

SYNTHETIC RUBBER

Definition: Synthetic rubber is classed as a man-made elastomer that has many of the properties of natural rubber without some of natural rubber's limitations. It is made by the same method of cutting rubber into ribbons as described for natural rubber. It may be used bare or covered with textile yarns.

Advantages:

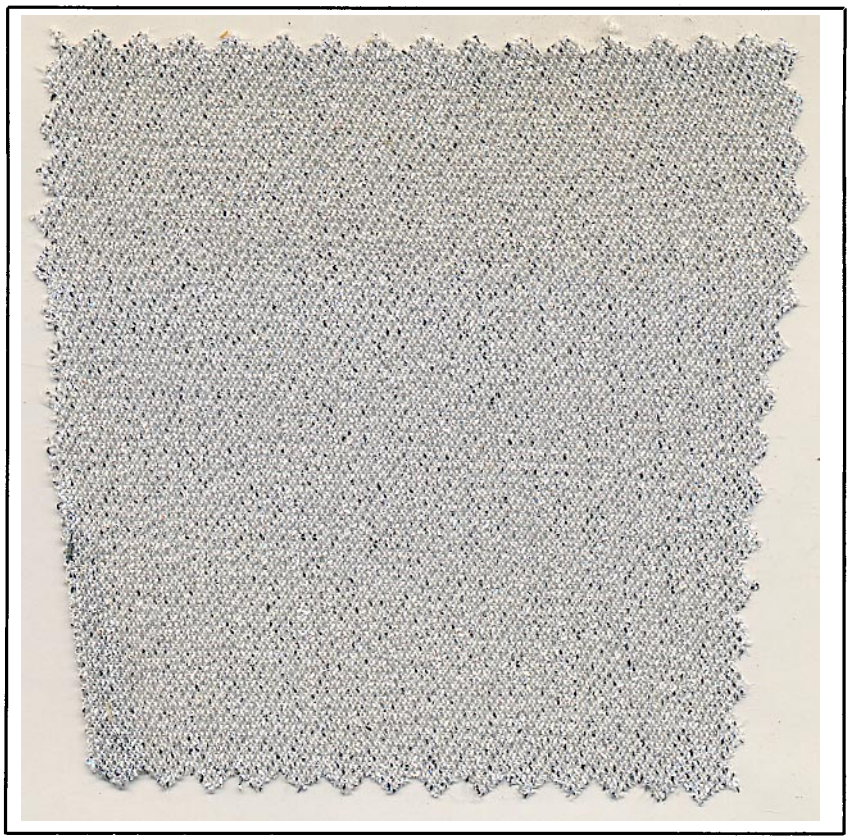
- Synthetic compares favorably with natural rubber in strength and holding power.
- It can be used to make very light-weight fabrics to medium and heavy-weight fabrics.
- It is used for webbings, waistbands, stretch fabrics. Many decorative treatments and surface designs may be created with the use of synthetic rubber yarns.
- Synthetic rubber may be drycleaned or wetcleaned.

Disadvantages:

- If not properly cured, some syntheitc rubber becomes tacky from perspiration and drycleaning.
- Strains from stretching may cause the yarns to break. This results in loss of elasticity.

14. Metallic

As defined by the Federal eral Trade Commission, metallic is a manufactured fiber composed of metal, plastic-coated metal, metal-coated plastic, or a core completely covered by metal.



Berman—White Gold, 72% Rayon, 28% Lurex C-50—The Dow Chemical Company

METALLIC FABRIC

Definition: Three thousand years ago gold and silver were hammered into thin sheets, cut into strips and woven into fabrics. Later gold- and silver-plated copper filament yarns were made. American-made yarns can be compared to a sandwich. Metal foil, metalized pigment and coloring matter are placed between layers of transparent plastic film. An adhesive binds all the layers into one film.

There are three methods of making metallic yarn:

(1) Aluminum foil or film is placed between two outer films and laminated with a clear adhesive. To make a gold yarn, a colored pigment is added to the adhesive. Any other color is made the same way by adding the particular pigment or coloring desired.

(2) Metalizing a clear plastic film by exposing it to aluminum vapor under high vacuum produces a sheet that can be cut into yarns. Clear adhesives and colored pigments are used to make colored yarns. This method produces a bright, lustrous yarn.

(3) A textile core yarn is wrapped with a metallic yarn. This produces a very fine flexible yarn.

Advantages:

- A variety of decorative effects may be achieved in fabrics with the use of metallic yarns.
- Metallic yarns do not shrink unless they are sensitive to heat.
- American-made metallic yarns do not tarnish.
- Those made with acetate-butyrate may be drycleaned or wetcleaned.
- Those made with cellophane are drycleanable; they should not be wetcleaned.
- Those made with Mylar® (a transparent polyester) may be drycleaned or wetcleaned.
- Can be pressed with an iron at the low or synthetic setting.

Disadvantages:

- The quality of metal yarns varies. (See page 243.)
- The use of a poor adhesive may cause the yarn to delaminate in wear or in drycleaning.
- Metallic yarns may pucker if used in a fabric that shrinks.
- Fabrics containing metallic yarns are subject to abrasion. Sometimes a metallic yarn will cut another metallic yarn, causing fabric damage.
- Some metallic yarns are made with solvent-soluble dyes. They have been known to cause dye stains on a fabric.
- The aluminum color may be removed if the adhesive is affected; if the dye leaches; or by bleaching. Very narrow yarns or stretching of the yarn contribute to this type of damage.
- Yarns that are made wtih a butyrate film may be damaged by some common spotting agents such as acetone.
- Several types of metallic yarns are affected by perchlorethylene.

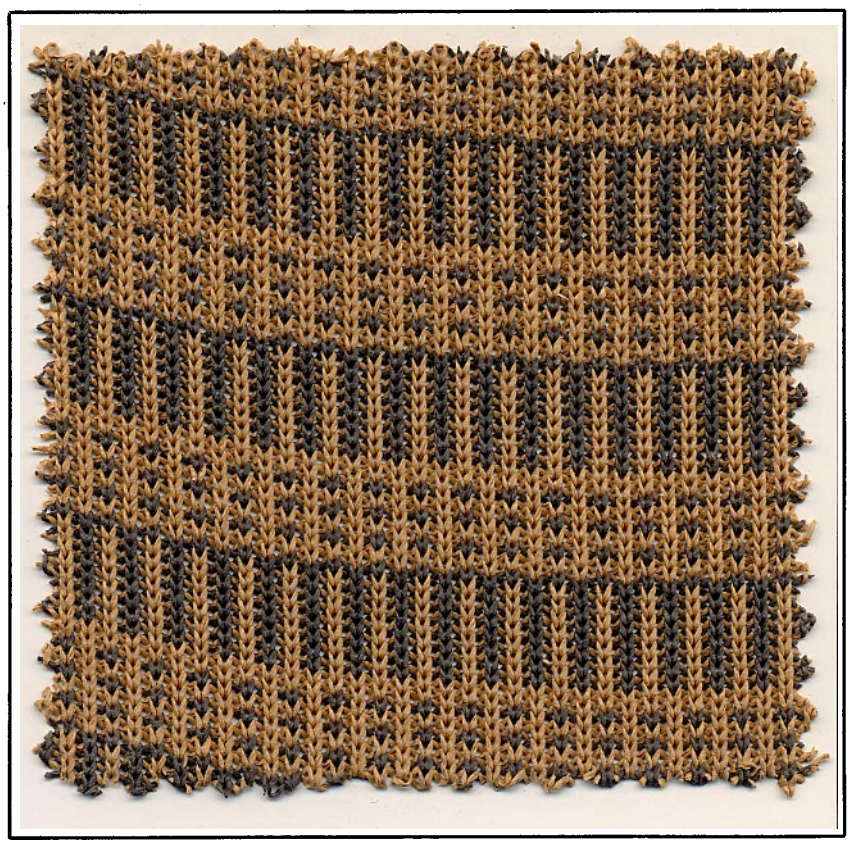
METALLIC YARNS

TRADE-MARK NAME	MANUFACTURER	DESCRIPTION	USES
Chromeflex-MM	Metal Film	Metallized Mylar laminated to clear Mylar; can be laundered or drycleaned	Apparel and decorative fabrics.
Chromeflex-MF	Metal Film	Foil laminated to Mylar	Apparel and decorative fabrics.
Fairtex	Fairtex	Cellulose-acetate-butyrate film, aluminum foil. Withstands temperatures up to 160° F.	Dress, drapery and upholstery fabrics.
Fairtex with Mylar (metallized type)	Fairtex	Mylar film laminated to a metallized film	Novelty, drapery, upholstery fabrics, rugs, towels, bedspreads.
Fairtex with Mylar (foil type)	Fairtex	Mylar film laminated to aluminum foil	Same as above; used particularly in washable fabrics.
Lamé	Standard Yarn Mills	Aluminum foil laminated between two plastic films; passes drycleaning and laundering tests	Knit and woven dress fabrics; drapery and upholstery fabrics; braids and trim.
Lamé with Mylar	Standard Yarn Mills	Two constructions: (a) aluminum foil laminated between two Mylar films; (b) laminated Mylar to metallized film; Mylar film on either side or both. Drycleanable; may be ironed at 300°F.; resists most chemicals; abrasion-resistant	Mostly in towels, bath mats, bedspreads, etc., that require extreme conditions of laundering, drycleaning, ironing.
Lurex metallic yarn	Dobeckman (Dow Chemical)	Silver yarns produced by laminating aluminum foil between two films of cellulose acetate butyrate; colored yarns obtained by adding pigments to bonding agents; multicolors produced on both faces of yarn; can be laundered or drycleaned	Menswear, coating, knitted and woven dress fabrics, curtain, drapery, upholstery fabrics, trims, towels, other household fabrics.
Lurex MM (made with Mylar)	Dobeckman (Dow Chemical)	An aluminized film; good light-fastness	Knits, laces, embroidered fabrics.
Lurex MF (made with Mylar and foil)	Dobeckman (Dow Chemical)	Bright aluminum foil is laminated between Mylar films; colored yarns produced by adding pigments to bonding agents	Fabrics that require resistance to chemicals.
Lurex 50C	Dobeckman (Dow Chemical)	Information not available	Knit fabrics.

METALLIC YARNS

TRADE-MARK NAME	MANUFACTURER	DESCRIPTION	USES
Malora	Malina	Aluminum foil laminated between acetate butyrate; can be laundered or dry-cleaned	Upholstery, drapery, dress fabrics, novelties.
Malora with Mylar	Malina	Mylar laminated to aluminum foil; dry-cleanable	Linens, upholstery, shirting materials.
Metlon metallic yarn	Metlon	Laminated extremely bright aluminum foil between two specially formulated plastic films. Washing temperature should not exceed 160°F. Drycleanable. Ironing temperature same as for acetate fabrics	Trims, drapery and upholstery fabrics, table linens, bedspreads, men's and women's apparel fabrics.
Metlon with Mylar	Metlon	Two types: (a) Metlon F (foil), aluminum foil laminated between two films of Mylar; (b) Metlon V (vacuum), laminating a clear Mylar film upon which there has been a vacuum deposition of aluminum	Same as above and towels, sheets and rugs.

15. PAPER



Pap-O-Net—Enterprise, Incorporated

PAPER FABRICS

Definition:

Paper fabrics may be classed and described as follows:

1. *Knit Paper Fabric:* A specially-treated high strength paper yarn is knitted into a variety of knit and mesh constructions for use in wearing apparel and household items. The yarns may be in natural color, bleached or dyed. Paper yarns may be combined with natural or synthetic yarns in different fabric constructions. The fabrics can be drycleaned. Knit paper fabrics are also being used as "sandwiches" in the plastic and leather field.

2. *A Non-Woven Paper Product:* This is said to be wetcleanable. Claims state it may be soft or stiff, depending on the purpose for which it will be used, and with controlled tear strength. Samples of dresses, men's shirts, and bathing suits first shown in 1955.

3. *A Woven Paper Product:* This product called "Papertex" was first shown in 1955 at the World Trade Fair. It is a lightweight nylon woven fabric coated with chemically bonded acrylic resin. It was developed by Snia Viscosa of Milan, Italy.

An American company, Resiova, Inc., will make the American product. Proposed consumer uses are rainwear, ski jackets, heavy weather outer clothing, upholstery fabrics, shoes and handbags.

Advantages:
- Advantages claimed for these paper products are non-combustible, impervious to insect and water damage, tear-proof, dimensionally stable.

Disadvantages:
- Only time and consumer reaction will point up the advantages and disadvantages of paper wearing apparel and household items.

16. NYTRIL

As defined by the Federal Trade Commission, nytril is 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.

Darvan, a nytril fiber produced by Celanese Fiber Co., is no longer being commercially made in the United States.

In 1961 Celanese reached an agreement with Farbwerke Hoechst of Germany to build a jointly owned plant, within the Common Market, to produce and market Darvan. In Germany the fiber is marketed under the name "Travis" fiber. The fiber is imported into this country under the name "Darvan."

17. AZLON

As defined by the Federal Trade Commission, azlon is a manufactured fiber in which the fiber-forming substance is composed of any regenerated naturally occurring proteins.

Azlon fibers are not currently in production in the United States. Aralac (casein from milk) and Vicara (zein from corn) were examples of azlon produced in the United States.

Azlon fibers are manufactured in Europe under many trade names. Common ones are: Ardil and Fibrolane (made in England), Lanital (made in Belgium and Italy), Merinova (made in Italy), Enkasa (made in Holland), and Alginate, which is made from seaweed (England).

C. FIBER IDENTIFICATION

Fiber identification is not a simple matter. Knowledge and skill are important. In some cases laboratory facilities and expensive equipment are required.

There are five methods that may be used alone or in combination to identify fibers. They are:

1. Burning test.
2. Microscopic examination (longitudinal and cross-section).
3. Chemical tests (solubility of fibers in various reagents).
4. Staining tests (fibers are dyed or stained with reagents).
5. Fiber density (each fiber has its own specific gravity.

Burning tests may give a clue to fiber type. Microscopic examination and staining tests may serve to confirm identification by using the burning test. Chemical and fiber density tests are necessary, particularly when relying on separation of individual fibers used in a blend.

In some instances the burning test, microscopic, staining, chemical and fiber density tests are of little value or use for fiber identification purposes. The use of an infra-red spectrophotometer is the most accurate method of identifying the synthetic fibers.

BURNING TEST

Test Procedure:

Pull a yarn from the warp or lengthwise direction of the fabric. Bring a lighted match to the edge of the flame. Observe the rate of burning, odor, and type of ash. Repeat, using a filling or crosswise yarn. Repeat, using a sample of the fabric.

Caution:

Hold the yarns or fabric with a pair of tweezers. Do not allow molten material to drop on your skin. It can cause a severe burn.

BURNING TEST

FIBER	RATE OF BURNING	ODOR	APPEARANCE OF ASH
Cellulosic Fibers			
Cotton	Yellow flame. Smolders with a creeping ember	Burning paper	Small, fluffy gray ash.
Linen	Bright yellow flame. Smolders with a creeping ember	Burning paper	Small, fluffy gray ash.
Ramie	Yellow flame. Smolders with a creeping ember	Burning paper	Small, fluffy gray ash.
Jute	Yellow flame. Smolders with a creeping ember	Burning paper	Small, fluffy gray ash.
Protein Fibers			
Silk	Burns in short jumps, sizzles. Does not smolder	Burning feathers	Round black bead, brittle, pulverizes easily.
Weighted Silk	Does not burn after flame is removed. Chars	Burning feathers	Leaves ash the form or shape of fiber or fabric. Glows like a red hot wire.
Wool	Burns slowly, sizzles, small flickering flame. Does not smolder after flame is out	Burning hair	Lumpy, blistered ash, brittle, breaks easily.
Man-made Fibers			
Rayon, including Avron, Corvel, Topel, Avril, Zantrel, Fortisan.	Burns very rapidly. Sometimes leaves a creeping ember	Burning wood or paper	No ash.
Acetate	Melts and sizzles as it burns with yellow flame	Odor of acetic acid	Hard black bead that can't be pulverized.
Arnel	Fuses away from flame. Burns with melting. Continues to burn with melting	Burning paper	Brittle, black, irregular-shaped bead.
Nylon	Melts before burning. Bubbles as it burns	Burning sealing wax, boiling string beans	Amber beads that cannot be pulverized.
Nytril	Fuses away from flame. Burns slowly while melting.	No characteristic odor	Leaves hard, black, irregular-shaped bead.
Glass	Melts. Does not burn	None	Hard bead-like ash.
Acrylic (Orlon, Acrilan, Creslan, Zefran)	Melts as it burns (similar to acetate) with a yellow flame and black smoke	Acrid odor. Pungent	Hard, black ash. Can be crushed. If crushed before cooling, ash will stick to fingers and burn them.
Modacrylic (Dynel, Verel)	Rate of burning practically nil. Difficlt to ignite; self-extinguishing. Does not drip	Acrid odor. Pungent	Hard black ash.
Polyester (Dacron, Fortrel, Kodel, Vycron)	Burns as long as a match contacts it. Does not burn continuously but in short jumps, as does pure silk	Aromatic (sweet-smelling odor)	Hard ash. Creamy in color. Cannot be crushed between the fingers.
Saran (Saran, Rovana, Velon)	Fiber shrinks and melts. Does not burn.	Sharp acrid odor	Hard bead-like ash.
Olefin (Polypropylene, Polyethylene)	Fuses, shrinks and curls away from flame. Melts as it burns	Polypropylene, faint asphalt odor; Polyethylene, burning parafin odor	Hard, tough, tan round bead.
Spandex (Lycra, Vyrene)	Fuses but does not shrink away from flame. Burns with melting	Musty odor	Leaves a soft, fluffy, gummy ash.

MICROSCOPIC TEST

Test Procedure (Longitudinal)

1. Pull a yarn from the warp or lengthwise direction of the sample.
2. Tease the yarn apart into fibers.
3. Mount the fibers on a slide with a drop of distilled water. Place a cover glass over the mount.
4. Examine at low magnification (50 to 60x).
5. Examine under high magnification (250 to 500x).
6. Compare with a known sample or photomicrograph.
7. Repeat with a yarn pulled from the filling or crosswise direction of the fabric.

Test Procedure (Cross-section)

Considerable technique is required to make cross-sections of textile fibers. See the American Society of Testing Materials Test Method D 276-62T or Technical Manual of the American Association of Textile Chemists and Colorists, Method 20-1963T.

MICROSCOPIC APPEARANCE

FIBER	LONGITUDINAL	CROSS-SECTION
Cellulosic Fibers		
Cotton	Ribbon-like. Convolutions sometimes change direction. No significant lengthwise striations	Tubular with tubes collapsed and irregular in shape. Very large size.
Linen	Bamboo-like. Pronounced cross-markings nodes and fissures. No significant lengthwise striations	Similar to cotton.
Ramie	Similar to linen but much larger. Very heavy cell walls and well defined lumen or broad and flat wall with indistinct lumen	Thick, irregular convolutions.
Jute	Long cell elements with frequent joints. Uneven in diameter. Broken tissue usually evident. Broad lumen	Irregular-shaped with central lumen.
Protein Fibers		
Silk (Weighted Silk)	Smooth surface like a glass rod. No significant lengthwise striations	Triangular. Points of triangle are rounded. Irregular in size and shape.
Wool	Serrated surface and cross-markings due to surface scales	Round or nearly round.
Man-made Fibers		
Rayon (Fortisan, Corval, Topel, Viscose)	Very distinct lengthwise striations. No cross-markings	Irregular shape. Serrated outline.
Cuprammonium	Smooth glass-like rod	Round.
Acetate-Arnel, Fortisan, Darvan	Glass-like rod with distinct lengthwise striations. No cross-markings	Irregular shape. Serrated outline.
Nylon	Glass-rod. Smooth surface	Round or nearly round.
Nytril	Distinct lengthwise striations	Irregular shape. Serrated outline.
Glass	Rod-like with smooth surface	Round cross-sections.
Acrylic Orlon	Broad. Indistinct lengthwise striations. No cross-markings	Dog-bone.

MICROSCOPIC APPEARANCE

FIBER	LONGITUDINAL	CROSS-SECTION
Acrilan, Creslan, Zefran	Rod-like. Smooth surface and outline	Round or nearly round. May include bean shape.
Modacrylic		
Dynel	Lengthwise striations. No cross-markings	Ribbon-like; irregular.
Verel	Broad and often indistinct lengthwise striations	Dog-bone.
Polyester		
Dacron, Fortrel, Kodel, Vycron	Rod-like with a smooth surface and outline	Round or nearly round.
Saran	Rod-like with a smooth surface and outline	Round or nearly round.
Olefin		
Polyethylene, Polypropylene	Rod-like with a smooth surface and outline	Round or nearly round.
Spandex		
Lycra	Broad. Indistinct lengthwise striations. No cross-markings	Dog-bone.
Vyrene	Dark. Very large. No cross-markings	Irregular shape. Very large size.

CHEMICAL SOLUBILITY TESTS

Chemical solubility tests are valuable to:

1. Determine the fiber content of an unknown fabric.
2. Verify or confirm other tests used to identify fibers.

Many solvents may be used to distinguish one fiber from another. The principle of solubility of the natural fibers is based on their reactions to common acid and alkaline solutions. The problem of solubility becomes a little more complex when dealing with the synthetic fibers. For this reason the fiber to be tested should be immersed in the liquids in numerical sequence. This is necessary if each class of fibers is to be systematically removed. However, if previous tests indicate that certain fibers are not present in the sample, the solvent may be omitted.

CHEMICAL SOLUBILITY OF TEXTILE FIBERS

Test Procedure: A specimen is placed first in one and then another of the liquids, using the numerical sequence shown below. (The liquid-to-specimen weight ratio should be at least 100 to 1.) In each liquid, the specimen is stirred periodically for 5 minutes, and the effect of the liquid on the specimen is carefully noted. Special illumination may be required to observe the results of the test.

Small clumps of fibers, short lengths of yarn, or small pieces of fabric can be used as test specimens; however, if there is any doubt about the results, individual fibers should be tested. Such fibers must be carefully selected from the textile material to assure that specimens of each fiber present are tested. Selection of the individual fibers can be facilitated by use of a magnifying glass or microscope.

Effect of Liquid: I = Fiber insoluble. P = Fiber partly soluble or partly disintegrated. S = Fiber soluble or completely disintegrated.

CAUTION: These are hazardous liquids and should be handled with care. Chemical laboratory exhaust hoods, gloves, aprons, and goggles should be used for fiber solubility work.

Chemical Agent	Concentration† (% by wt.)	Density (at 75°F.)	Temp. (°F.)	Acetate	Nylon	Silk & Wool	Olefin & Saran	Modacrylic Acrylic	Modacrylic & Nytril	Spandex	Cotton Flax Rayon	Polyester
1. Acetic Acid, glacial	....	....	75	S*	I	I	I	I	I	I	I	I
2. Hydrochloric Acid	20	1.096	75	I	S	I	I	I	I	I	I	I
3. Sodium Hypochlorite solution (pH 11)	5% Avail. Chlorine	....	75	I	I	S**	I	I	I	I	I	I
4. Xylene (meta —)	....	....	282††	I	I	I	S***	I	I	I	I	I
5. Ammonium Thiocyanate	70	....	266††	I	I	I	I	S	I	I	I	I
6. Butyrolactone	....	....	75	S	I	I	I	I	S§	I	I	I
7. Dimethyl Formamide	....	....	200	S	I	I	I&S	S	S	S	I	I
8. Sulfuric Acid	75	1.665	75	S	S	S&I	I	S&I	I	P	S§§	I
9. Cresol (meta —)	....	....	200	S	S	I	I	I	P	P	I	S

† If not otherwise specified, the concentration was approximately 100%. Where lower levels of concentration are specified, water was used as the diluent.

†† At the boil.

* Vigorous agitation may be required to dissolve triacetate fibers in the specified time. A more rapid dissolution can be accomplished at a temperature of 100°F.

** Silk and wool fibers can be separated by dissolving the silk in concentrated (37 to 38%) hydrochloric acid at 75°F. Wool fibers are not soluble.

*** Olefin and saran fibers can be separated by dissolving the saran in dioxane-1,4 at 200°F. Olefin fibers are not soluble.

§ Modacrylic and nytril fibers can be separated by dissolving the nytril in 60% nitric acid (density = 1.362) at 75°F. Modacrylic fibers are not soluble.

§§ Rayon fibers can be separated from cotton and flax fibers by dissolving the rayon in concentrated (37 to 38%) hydrochloric acid at 75°F. Cotton and flax fibers are not soluble. Cotton and flax can be distinguished by their longitudinal appearance when observed with a microscope.

The data in this table should be used only for fiber identification tests, since their suitability for quantitative analysis tests has not been determined in all cases.

Courtesy E. I. duPont de Nemours & Co., Inc.

DYE AND STAIN TESTS

A number of different stain tests are used to identify synthetic textile fibers. Various dye manufacturers prepare dyes and stains for this purpose. These tests are applicable only to white or light-colored fibers. If you wish to identify a colored fabric or fiber, it is first necessary to strip the dye. Most manufacturers provide instructions on staining procedures as well as cards showing the typical color of each fiber after staining. It is sometimes difficult to distinguish one fiber from another in blended yarns or fabrics because they are stained approximately the same color. In such a case, examine the stained material under a microscope. Compare them with a standard colored specimen. It is advisable not to rely on one staining solution. Several different identification stains will confirm the fiber classification.

Methods of staining may vary slightly, but in all cases the fiber should be wet out thoroughly in hot water before dyeing. Place the fiber in the dye solution recommended by the manufacturer. Remove the material, rinse lightly and dry before you evaluate.

STAINING OTHER THAN GENERAL DYE STAIN *

Cellulosic Fibers	
Cotton	Unstained by zinc chloride iodine.
Linen	
Protein Fibers	
Silk	None characteristic.
Wool	None characteristic.
Man-made Fibers	
Rayon-Viscose	Unstained by Brilliant Benzo Blue 6BA. Tinted blue with Anthraquinone Blue SWF. Distinguishes from Cuprammonium and Fortisan.
Cuprammonium	Deep blue with Brilliant Benzo Blue 6BA. Distinguishes from Viscose and Fortisan.
Fortisan	Unstained with Anthaquinone Blue SWF and Brilliant Benzo Blue. 6BA distinguishes from Viscose and Cuprammonium.
Acetate	Not charasteristic.
Arnel	Not charasteristic.
Nylon	Not characteristic. Use DuPont Stain No. 4. Stains deep red. Texchrome—stains yellow.
Nytril	Unstained with Anthraquinone Blue SWF. Distinguishes from Dynel and Verel.
Glass	Not characteristic. No staining.
Acrylic	
Acrilan	Blue with Anthraquinone. Blue SWF distinguishes from Orlon. Pink with Fastusol Pink. BBA distinguishes from Zefran and Creslan.
Creslan	None characteristic.
Orlon	Unstained by Anthroquinone Blue SWF.
Zefran	Stained red with Fastusol Pink BBA.
Modacrylic	
Dynel	Stained blue with Anthroquinone Blue. SWF distinguishes from Verel.
Verel	Stains pale blue with Anthraquinone Blue. SWF distinguishes from Dynel.

Polyester	
Dacron	Unstained with alcoholic Anthraquinone Blue SWF.
Kodel	
Saran	None characteristic.
Olefin	
Polypropylene	None characteristic.
Polyethylene	None characteristic.
Spandex	
Lycra	None characteristic.
Vyrene	None characteristic.

* For more complete information on staining of fibers, see *Man-Made Textile Encyclopedia*, pages 159-162.

SPECIFIC GRAVITY OF TEXTILE FIBERS

FIBER	SPECIFIC GRAVITY
Cellulosic Fibers	
Cotton	1.50–1.55
Linen	1.50–1.55
Ramie	
Jute	
Protein Fibers	
Silk	1.25–1.35
Wool	1.28–1.33
Man-made Fibers	
Rayon	
Viscose	1.46–1.52
Cuprammonium	1.54
Fortisan	1.52
Acetate	
Acetate	1.30–1.35
Arnel	1.3
Nylon	1.14
Nytril	1.18
Glass	2.54

FIBER	SPECIFIC GRAVITY
Man-made Fibers	
Acrylic	
Acrilan	1.17
Creslan	1.17
Orlon	1.17
Zefran	1.175
Zefkrome	1.17
Modacrylic	
Dynel	1.31
Verel	1.37
Polyester	
Dacron	1.38
Fortrel	1.38
Kodel	1.22
Vycron	1.36 –1.38
Saran	
Saran	1.68 –1.75
Velon	1.68 –1.75
Olefin	
Polyethylene	0.90 –0.92
Polypropylene	0.90 –0.92
Spandex	
Lycra	1.21
Vyrene	1.35
Orofil	1.30
Rubber	1.07 –1.15

SPECIFIC GRAVITY OF TEXTILE FIBERS

Test Procedure:

1. Prepare the test liquids of known specific gravity.
2. Before using any liquid for fiber identification, check its specific gravity with a calibrated hydrometer.
3. A suitable series of liquids may be prepared by mixing in various proportion, carbon tetrachloride (specific gravity of 1.60 at room temperature) with xylene (specific gravity of 0.87 at room temperature).
4. Place a single fiber or filament in the series of specially prepared liquids of known specific gravity. If the specific gravity of the fiber is greater than the liquid, the fiber or filament will sink in the liquid; if the specific gravity of the fiber is lower, the fiber or filament will float.