

Metallic Yarns and Fibres in Textiles



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ABSTRACT

This paper deals with the types of metal yarns, known for about 3000 years, their manufacturing processes, care and maintenance, uses of metallic yarns and fibers in the textile and other industries; in general the metal yarns are used in sarees known as “zari”. Recently it has found new application in electronic textiles, better known as “smart textiles”. These yarns have also entered into the fiber and fashion industry. The gold and silver filaments were the first man-made yarns. As technologies developed, the coated and different coloured metallic yarns are being produced for various applications.

INTRODUCTION

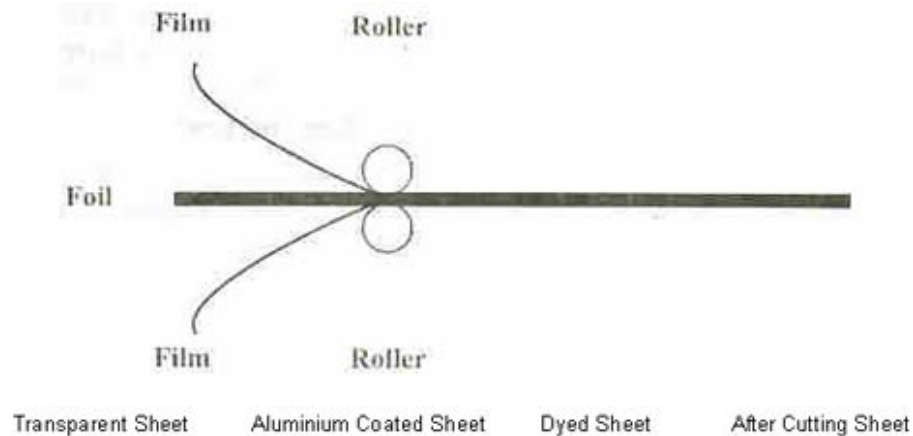
Metallic yarns have found its applications in various fields of textiles like conductive textiles, smart textiles, and fashion industry. Gold and silver filaments were the first man made yarns, as revealed by the history. In recent years, with the advancement in the technologies, new coloured and coated metal fibers and yarns are being produced now-a-days. These yarns are wrapped around some of the natural yarns like cotton to make them conductive and these yarns have found intensive place in the technical textiles.

MANUFACTURING PROCESS OF METAL YARNS

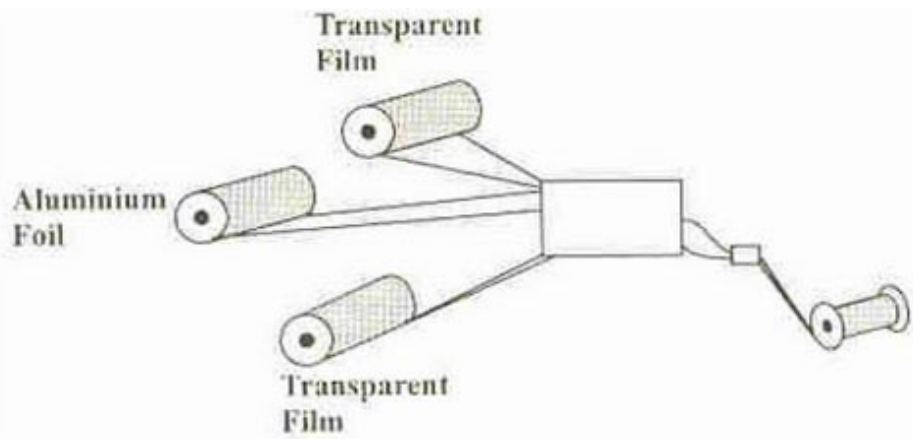
The raw material used is a roll of aluminium foil of 0.00045 inch thickness and 20 inch wide. On the both sides of the sheet a thermoplastic adhesive is applied, and the required colouring matters is also added. Then the adhesive-coated foil is heated to about 90-95°C, and a sheet of cellulose acetate-butyrate transparent film is laminated to each side of the foil by passing through squeeze rollers at a pressure of 2000 lb/in. The laminated material is then slit into filaments of the required width; the most popular width being made is 1/64 inch although other sizes from 1/8 inch to 1/120 inch are also made.

MANUFACTURING PROCESS OF METAL YARNS





The nature of the adhesive that is used is important and not usually disclosed. Gold is the most important colour which is produced by the addition of an orange-yellow dyestuff to the adhesive. Silver is simply the colour of the aluminium itself. Other colours such as bronze, peacock blue and red are obtained by using the suitable pigment. Multi-coloured effects, e.g. red and green alternating irregularly along the length of the yarn, are obtained by pre-printing the plastic film and laminating in the usual way.



SLITTING OPERATION

The slitting operation involves the two main types of cutting by which a metallised polyester film is converted into the tape filaments:

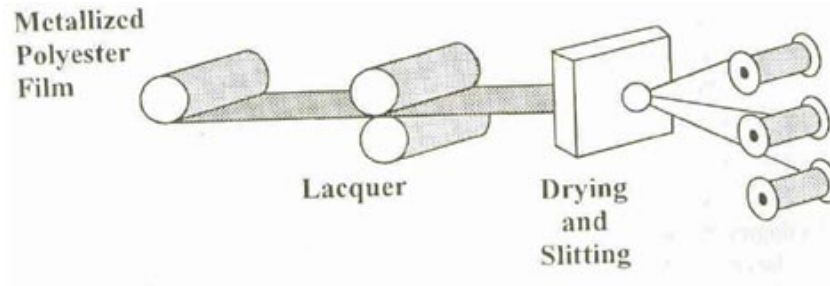
- ✓ Rough Slitter
- ✓ Micro Slitter

The metallized polyester film supplied to the slitting operation has the following parameters:

Thickness: Normally ranges between 12 to 25 Microns.

Length: Sheet in the form of roll having the length from 5000 to 10,000 meters.

Width: The width of the sheet ranges between 510mm to 1000mm.



ROUGH SLITTER

this slitter cuts the large polyester sheet into Pancakes. The width of the each Pancake is 54mm. In addition side strips of 2mm are kept extra on each side. Thus the resultant width of the pancake is 58mm.

Cutters of different size are used for this operation, for example 0.2mm, 0.23mm, 0.25mm, 0.30mm, 0.376mm, etc. Pancakes are also in the form of rolls supplied to the Micro Slitter.



MICRO SLITTER

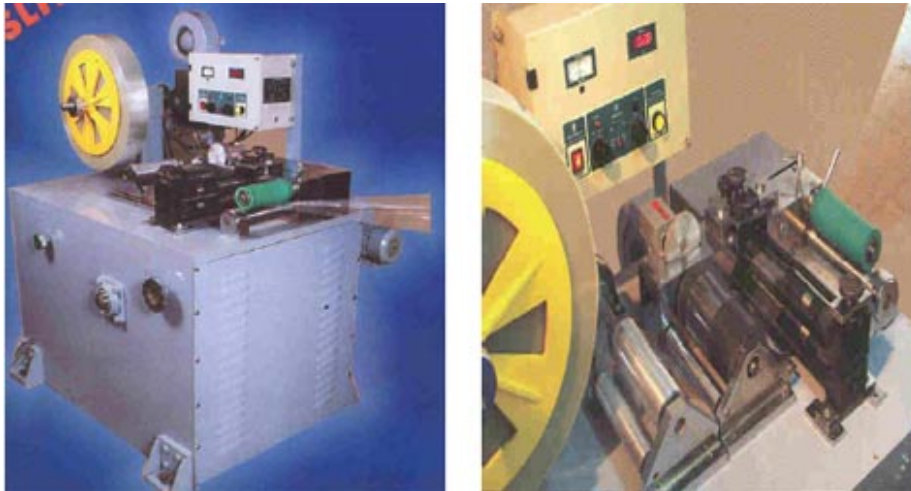
The Micro Slitter is a general name given to both slitter and winder for producing the yarn 0.15mm - 1 mm wide.

In this operation Pancakes are converted into numbers of tape filaments. It has two main parts, cutting mechanism and winding mechanism. Cutting of pancakes and winding of tape filaments are carried out simultaneously.

The cutting mechanism consists of two parallel shafts. On each shaft blades are mounted side by side such that the edge of one blade on one shaft slightly touches the edge of the blade mounted on the other shaft. The cutter is mounted on to the shaft with the help of Separator and Support Ring. The width of the tape filament decides the width of the cutter.

The winding mechanism consists of number of winding positions. The winder is driven by a separate motor. The traverse mechanism is also provided for obtaining the parallel wound package. The speed of

the winder is 2.5% to 5% higher than that of the cutter.



FINE STRUCTURE AND APPEARANCE

Metallic fibres are flat, ribbon-like filaments, commonly 3.2-0.2 mm (1/8-1/128 in) width. They are smooth-surfaced, and may be coloured or uncoloured.

PROPERTIES	ACETATE BUTYRATE, FOIL	POLYESTER, FOIL	POLYESTER, METALLIZED
Tenacity	2.6 cN/tex (0.3 g/den)	6.2 cN/tex (0.79 g/den)	11.0 cN/tex (1.25 g/den)
Elongation	30 %	140 %	140 %
Elastic Recovery	75 % at 5% elongation	50% at 5% elongation	100 % at 5 % elongation
Flex Resistance	1	18	70
Abrasion Resistance	fair	good	excellent
Effect of Moisture Regain	0.1 %	0.5 %	0.25 %
Softening point	205°C	232°C	232°C
Ageing	Nil	Nil	Nil

TYPES OF METALLIC YARNS

1. **Acetate Butyrate, Aluminium Foil:** A continuous flat monofilament composed of aluminium foil laminated on both reflective surfaces with cellulose acetate butyrate film.
2. **Cellophane Aluminium Foil:** A continuous flat monofilament composed of aluminium foil laminated on both reflective surfaces with Cellophane film.
3. **Polyester, Aluminium Foil:** A continuous flat monofilament composed of Aluminium foil

laminated on both reflective surfaces with polyester film.

4. **Polyester, Aluminum Metallized Polyester:** A continuous flat monofilament composed of aluminium Metallized polyester laminated on its Metallized surface or surfaces with polyester film.
5. **Polyester, Aluminium Metallized, Non-Laminated:** A continuous, flat monofilament composed of a single layer of aluminium Metallized polyester protected on its Metallized surface.

PROPERTIES OF THE METAL YARNS

- ✓ Highly conductive
- ✓ Radar reflective
- ✓ Light weight
- ✓ Flexible
- ✓ Antistatic behavior
- ✓ Cut resistant.

TYPES OF METAL COATING

- ✓ Metal coating with a binder
- ✓ Vacuum deposition
- ✓ Sputter coating
- ✓ Electroless plating

METAL YARNS IN INTERACTIVE ELECTRONIC TEXTILE

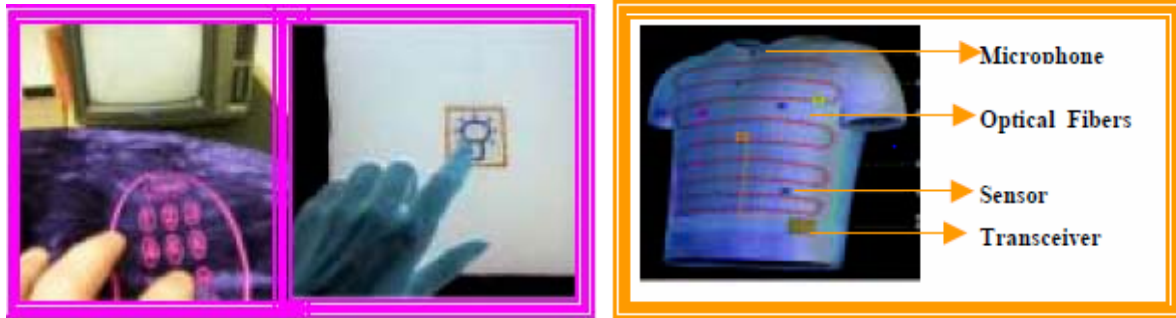
The following figures shows the use of metal yarns in interactive electronic textile



Integrated textile keypad



sleeve integrated communication device



(Left) remote control (Right) light switch smart shirt



Micrograph of metallic silk organza

USES OF METALLIC YARNS/FIBRES IN TEXTILES AND FASHION

Metallic yarns are not only used for decorating clothing and other fashion accessories. As these coated metallic filaments do not stain when suitable adhesives and films are used, they are not affected by salt water, chlorinated water in swimming pools or climatic conditions; they are most effective for making protective cloths and work cloths. Thus, these yarns are used for both, functional as well as decorative purposes.

1. The most common application of metallic fibers are in making upholstery fabrics like lame and brocade which are then used for making luxurious curtains, sofa covers etc.
2. Steel fibers are used in making carpets where they are dispersed along with other fibers. These fibers help to conduct electricity so that the static shock is reduced. Such carpets are often used in high volume computer areas where the chance of producing static shock is much greater.
3. As they are shock resistant, the metallic fabrics are also used in space suits, protective clothing, cut resistant gloves of butchers, and in garments for people who work with risky machinery.
4. These fibers are sometimes twisted with other fibers like wool, cotton, synthetic, and nylon to make yarns which give extra attraction to the finished garments.
5. Fashion designers often use these fibers to make ultra glamorous apparels for giving that extra edge to their clothing lines. Metallic fabrics of gold, silver and bronze are hot favorites with these professionals.
6. When not in cloths, they can be found on other fashion accessories such as handbags, belts, and even shoes.
7. These yarns are used in smart textiles.
8. used in conductive textiles
9. Widely used in sarees.
10. These fibers are extensively used for embellishing apparels, braids, draperies, laces,

military uniform decorations, ribbons, table linens, etc.

CARE AND MAINTENANCE

Metallic fabrics should be professionally dry cleaned with perchlorethylene. The fabric should be hand cleaned with woolite and cold water, and should never be bleached. Like other synthetic fabrics, metallic fabrics should be ironed at the lowest setting, without using a steam iron

NEW DEVELOPMENTS

- ✓ Multi-Functional Textiles
- ✓ Sensing yarn, woven/knitted into garments.
- ✓ Intelligent textile applications.
- ✓ Heatable textiles as the heating element.
- ✓ Conductive seam ribbons for Clean room garments.
- ✓ Stimulation electrodes knitted into garments.
- ✓ Weavable /knittable lead wires.
- ✓ Heatable textiles.
- ✓ EMI Shielding wall-coverings and other textile structures.

SOME OF MANUFACTURING BRANDS OF METAL YARNS

Dow Chemical Co.	Lurex
Fairtex Corp.	Fairtex
Melton Corp.	Melton
Reynolds Metals Co.	Re Aluminium
Standard Yarn Mills	Lame
Sildorex SA,France	Lurex C, Lurex TE.

SOME OF LUREX BRAND YARNS

DARK GOLD



SATIN GOLD



SILVER



WHITE GOLD



WHITE GOLD/BLK



LILAC



PEACH



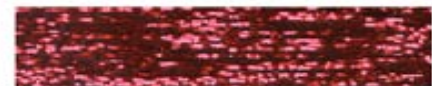
PINK



TURQUIOSE



FIESTA RED



COPPER



FUSCHISA



EMERALD GREEN



ROYAL PURPLE



CLARET



STEEL GREY



TECHNICAL DATA SHEET FOR LUTEX YARN

LUREX GENERAL TECHNICAL DATA SHEET			
TEST	CONDITIONS	TEMP./TIME	RESULT
Laundry	0,5% (5gr./liter) soap	40°C 20 min.	OK
Dry cleaning	Perchlorethylene 100%	20°C 30 min.	OK
Ironing		135 °C, 15 sec.	OK
Hot water		70 °C, 30 min.	OK
Steam		100 °C 10 min.	OK
Dry heating		100 °C, 60 sec.	OK
Scouring	1-2 gr/litre detergent only	70 °C 15 min.	NO
Overdye wool and nylon	1 gr./litre acetic acid, X% acid dyestuff	90 °C 30 min.	NO
Bleaching	Sodium hydrosulfite 2,0 gr./liter	70-80°C 30 min.	NO
Bleaching	Soda ash 0.5g/litre	70-80°C 30 min.	NO
Bleaching	Ph 9, 30% hydrogen peroxide	70-80°C 30 min.	NO
Bleaching	10% sodium hydrochlorite 40 gr./litre	70-80°C 30 min.	NO
Caustic soda		28 Be' 21°C	NO

CONCLUSIONS

The metallic fibers and yarns have taken the textiles to the next level in technical textiles more specifically in conductive and smart textile materials. The metal fibers and yarns have made the entry into the fiber and fashion industries. Besides aesthetic effects, they also provide stability to the structure, electromagnetic shielding and wearable textiles materials are also produced from the metallic fibres and yarns. In future, these applications are expected to increase with ever increasing use of the electronic goods and personal protection devices.

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Image Courtesy: etsy.com