

# Effect of Surface Modification Treatment on Gold Coated Zari Yarn And its Weavability Characteristics



R. Gobinath, V. Thamarai Selvan, S. Sowmmiya, S. Harinath

**Abstract:** The Zari yarn is a three component yarn which consists of red silk thread wrapped around by a silver wire and coated with pure gold. The Zari yarn is a metalized yarn and is basically manufactured by wrap spinning technique. In this work the zari yarn components has been treated with plasma reactor using argon and oxygen medium. The zari yarn is also made by using three different silk varieties as a core material. In initial stage the silk yarn is also degummed by using enzyme and also by traditional method. The effect of plasma treatment in each stage has been examined. After plasma treatment the frictional properties of zari yarn is interpreted. The weavability factors for the zari yarn also measured in the research.

**Key words:** Zari Yarn, Wrap Spinning Technique, Plasma Treatment, Frictional Properties, Degumming, Enzymes.

## I. INTRODUCTION

Zari yarn is a three component yarn; in this the core is Eri, Tassar and Mulberry silk. Around the core of silk yarn silver wire wrapped by the wrap spinning technique and then gold is coated over the silver wire by means of electroplating process. By this way gold coated zari yarn is manufactured. Zari yarn has many components in it. Silk is the important core component in real zari. Silk is said to be the queen of textile fibres and the products made out of it are lustrous and have good handle two types of silks, namely, mulberry and are produced in India. Silk is a protein fibre and unlike wool has a higher strength and low elongation. To improve and modify the surface characteristics of fibers now we have many modern techniques in that one plasma treatment is one of the mostly followed and valued techniques. Plasma treatment available in both oxygen and argon gas this will be helpful to modify the zari yarn structure and to improve the life time of

gold coating on zari yarn. Plasma treatment available in both oxygen and argon gas this will be helpful to modify the zari yarn structure and to improve the life time of gold coating on zari yarn. The tensile strength and elongation of the silk filament in the core plays an important role in determining the evenness of the wrap and thereby influencing the quality of the resultant zari. Electrical conductivity and yarn friction values are checked as per the testing procedure to improve the gold coating life time in zari saree.

## II. LITERATURES

[8] Silk is a protein fibre and unlike wool has a higher strength and low elongation.

[2] Silk polymer is a linear, fibroin polymer. Silk is composed of sixteen different amino acids. Three of these sixteen amino acids, namely alanine, glycine and serine, make up about four-fifths of the silk polymers composition.

[10] Silk filament is strong in nature because of its linear structure and then, beta-configuration polymers and very crystalline polymer system.

This two are the main reasons in the silk material to permit more hydrogen bonds in its structure but its treated with water the more amount of hydrogen bonds presents in the material will hydrolyze, so silk material will lose its strength.

The handle of the silk is described as a medium, and its very crystalline polymer system imparts a certain amount of stiffness to the filaments. This is often misinterpreted, in that the handle is regarded as a soft, because of the smooth, even and regular surface of silk filaments says Carty P. (1996)<sup>2</sup>

[3] In nature silk is a very crystalline structure compared with wool, so amorphous region is very low compared with wool fiber. So this structure will not allow more water to penetrate in the structure like wool fiber. Because of this reasons here plasma treatment plays an important role to modifying structure.

In silk polymer structure salt linkages, cystine linkages, hydrogen bond linkages and van der waals forces are holds the polymer system of silk together.

When we treat the silk fiber with the alkaline solution obviously it will reduce the intermolecular forces between the different linkages of silk and then the crystalline region of the silk filament also drastically affected. So the action of alkaline on silk should be avoided and prolonged usage of alkaline on silk material will destroy the material.

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The cross sectional shape of the silk filament is triangular so that it shows high luster compared with other textile materials.

[9] Plasma is a fourth state of matter and it's a ionized gas containing highly energetic electrons and positive ions, this will provide unique surface properties on the textile materials.

[1] The application of plasma treatment is more in the field of textile industries rather than other industries. Here oxygen plasma is used in the cotton fabric for the purpose of softening and to improve the dye ability. Plasma treatment is used to reduce felt on wool materials considerably and then in the rayon fabric antistatic finish is given by the application of plasma treatment.

S.No	Particulars	Details
1	Type of Machine	Plasma systems
2	Model	HPVT-PS
3	Gas to be used	Oxygen
4	Distance between plates	3 cm
5	Plasma voltage	400 Volts
6	Plasma Treatment Time	3 Minutes

[11] The traditional Kancheepuram silk saree is unique still; the reason is the quality and gold content percentage and the price of the product. It will be not there in the imitative zari and other types.

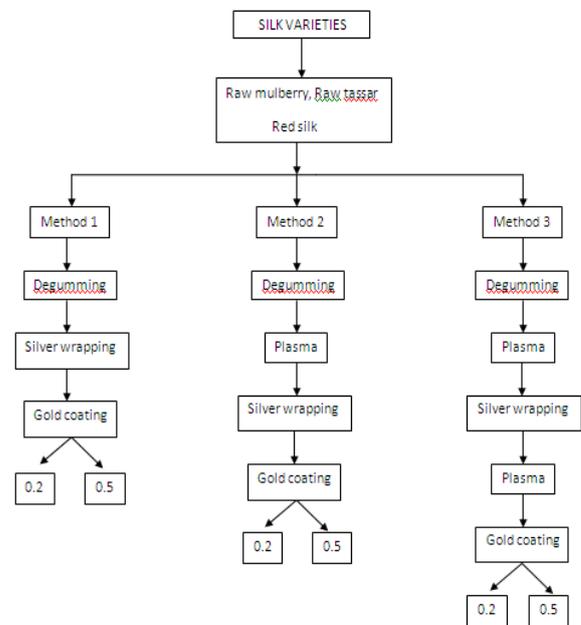
[8] The low temperature plasma treatment applied for the silk yarn by the electro plating process and the same time the tensile strength for the silk yarn, before and after the application of plasma is measured. Its shows reduced tensile strength value after the plasma treatment and then the morphology structure of silk yarn also changed completely.

### III. MATERIALS AND METHODS

Materials:

- ❖ Raw mulberry
- ❖ Raw tassar
- ❖ Red silk(ERI)

Methodology:



### DEGUMMING METHODOLOGY (USING DETERGENT)

S.No	Item	Quantity
1	<b>Recipe:</b>	
	a) Commercial Detergent	4 gm./lit.
	b) Non-ionic Wetting Agent	4 gm./lit.
	c) M:L ratio	1:20
2	<b>Conditions:</b>	
	a) Temperature	100°C
	b) Duration	60 Minutes

### IV. PLASMA TREATMENT METHODOLOGY

S.No	TYPE OF SILK	DEGUMMING WEIGHT LOSS (%)
1	Mulberry	23
2	Tassar	31
3	Red silk	30

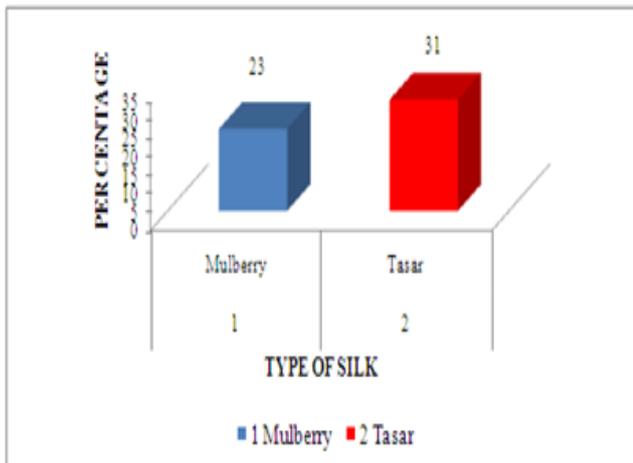
Degumming weight loss (%)

### V. TESTING RESULTS WITH GRAPH DISCUSSION

The test results of the studies are tabulated below. Test results of the samples both before and after plasma treatment is tabulated. Laboratory testing has been conducted in the Instron Tester to find out the values of tensile strength and elongation.

VI. SILK YARN TEST RESULTS

Degumming Weight Loss



Degumming weight loss percentage of tassar silk is observed to be slightly higher than mulberry silk yarn which varies depending on the sericin content in raw silk yarns.

Average Tensile Strength of Zari Components – Before & After Plasma Treatment

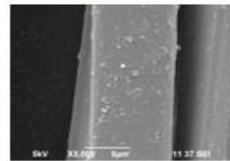
Among the three components of zari yarn, the silver wrapped red silk yarn and gold coated zari shows a considerable decrease in average tensile strength values when compared to red silk yarn which is due to increased etching which occurs over the surface of both these yarns. The linear density of both silver wrapped red silk and zari is also a notable factor as far as decrease in average tensile strength values are concerned.

SILK YARN AND ZARI COMPONENTS TEST RESULTS SUMMARY

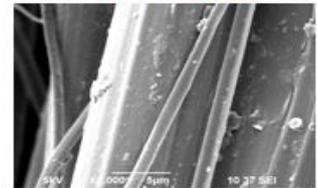
	GAUGE LENGTH 200 mm		GAUGE LENGTH 250 mm		GAUGE LENGTH 300 mm	
	BEFORE PLASMA TREATMENT	AFTER PLASMA TREATMENT	BEFORE PLASMA TREATMENT	AFTER PLASMA TREATMENT	BEFORE PLASMA TREATMENT	AFTER PLASMA TREATMENT
Raw Mulberry	26.57	20.95	28.31	20.16	37.89	22.87
Degummed Mulberry	16.61	13.41	17.59	15.68	18.35	15.35
Raw Tassar	36.84	29.15	36.66	25.70	27.45	25.67
Degummed Tassar	29.78	25.62	29.52	26.39	25.80	24.11
Red Silk	36.10	27.56	40.02	37.47	36.14	34.51
Silver Wrapped Red Silk	12.05	8.55	10.67	8.66	10.83	7.89
Zari	10.37	8.37	9.84	8.40	10.67	8.40

Comparison of Average Tensile Strength (gf/tex) From the above table the tensile strength of silk yarn is reduced when compared with before and after plasma treatment but it will not affect the strength of zari saree. SEM images:

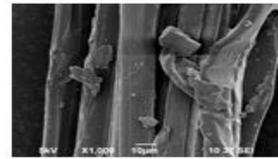
Gold coated Mulberry



Gold coated tassar



Gold coated red

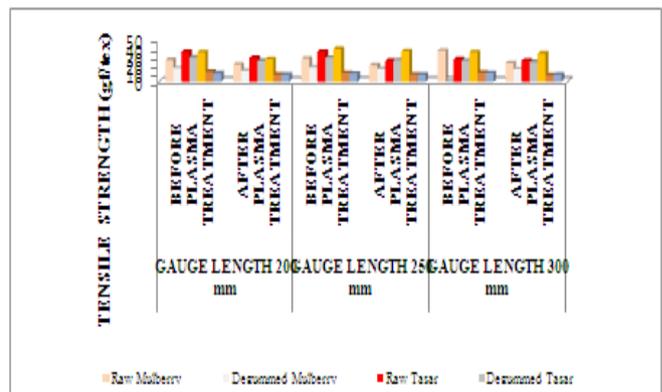


Scanning electron microscope images are used to see the gold coated effect (surface treated) on the silk yarn.

ELECTRIC CONDUCTIVITY RESULTS:

S.No	Materials	Electrical conductivity in (μΩ)
1	Red silk	0.0763 μΩ
2	Raw mulberry	0.0862 μΩ
3	Raw tassar	0.0562 μΩ
4	Gold coated mulberry	0.0867 μΩ
5	Gold coated tassar	0.0892 μΩ
6	Gold coated red silk	0.0922 μΩ

Electric conductivity effects of silk yarn is improved after the surface modification due to the silver wrapping over the core silk because silver is the good conductor of electric charge. Over the silver wrapped gold coating is applied, it will reduce the electric conductivity charge.



Yarn friction results (yarn to yarn abrasion):

Type of sample	0.2%	0.5%
Gold coated mulberry	0.19	0.2
Gold coated tassar	0.21	0.22
Gold coated red silk	0.23	0.25

Yarn friction values decreased compared with raw silk for the zari yarn by that way the durability of the zari saree is increased so far.

### VII. CONCLUSION

- The change in the gauge length (between 200 to 300) does not affect the average tensile strength values of Raw silk yarns(Mulberry/Tasar) and Degummed silk yarns(Mulberry/Tasar) both before plasma treatment and after treatment with oxygen gas.
- The change in the gauge length (between 200 to 300) does not affect the average tensile strength values of Zari yarn and its components (Red silk & Silver wrapped red silk) both before plasma treatment and after treatment with oxygen gas.
- After plasma treatment with oxygen gas, the average tensile strength values of raw silk yarns (Mulberry/Tasar) decreases.
- After plasma treatment with oxygen gas, the average tensile strength values of degummed silk yarns(Mulberry/Tasar) decreases.
- The decrease in average tensile strength (gf/tex) is higher in raw silk yarns (Mulberry/Tasar) than in degummed silk yarns (Mulberry/Tasar).
- The average tensile strength values (gf/tex) of red silk, silver wrapped red silk and Zari decreases after plasma treatment with oxygen gas.
- The decrease in average tensile strength (gf/tex) is higher in silver wrapped red silk yarn than in red silk and zari yarn.
- The gold coating content present in the three varieties are examined by SEM images & yarn friction, electrical conductivity results showing the more chances of zari yarn weavability factors.

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