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Compatibility of Different Fusible Interlinings with Goat Nappa Leather

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ABSTRACT
Suitability of fusible interlinings with leathers is very essential for comfort and fit of garments. Fusing reinforcement is a sort of material which sandwiched an upper leather of a particular product and base lining materials. Fusing interlining is the sheet of fabric between the upper leather and the lining materials. It's more often than not included to allow article of clothing extra warmth. At present, apparel manufacturing cannot be imagined without fusing process. In these endeavor, there are three different fusible interlinings like Tetoron Cotton (TC) pasting, Cotton pasting and Polyester pasting which are used with goat nappa leather and the performance has been measured in respect of bond strength, tensile strength, ball bursting strength, single edge tear load and double hole stitch tear load. The main feature of TC pasting is non-woven which is polyester/cotton blended. Cotton pasting is non-woven and polyester pasting is woven in nature. Latex adhesive has been used to join fused upper and fusible interlinings. After examining the overall performance, it is clear that polyester fusible interlinings performed nicely in the areas of tensile strength, bond strength, double hole stitch tear strength and bursting strength whereas cotton fusible interlinings exhibits higher performance in case of single edge tear strength. Finally, we can say that the overall performance is better for polyester interlinings. The outcomes not only emphasize the basic perception of the fusing attitude of fusing materials with nappa calf skin but also are helpful for leather product shape and design .

Keywords: Interlinings, macromolecular, nappa leather, polyester, TC pasting.

1. Introduction

Fusible interlining is one of the most essential and salient art work of asset that presently lack overview and inspection [1]. Actually, it is a strip of material placed between the upper leather materials and the lining of a product to supply garb a fabulous look and durability [2]. Use of reinforcing materials can assist to beat some of the poor aspects of shell cloth and supply appealing and fashionable look in the ultimate fabric [3]. Through the movement of positive temperature, time and weight, it can tie with texture straightforwardly. These changeable have a splendid have an impact on the bond power and the houses of the composite fabric obtained. Fusible interlining may be a frame of cloth whose base fabric is utilized with thermoplastic resin and features a durable authoritative control. They allow now not completely an additional beautiful outline, on the other hand additionally a relentless shape to articles of clothing distorted from twisting and shearing misshaping on carrying [4, 5–7]. Moreover, they are utilized to help the external texture so as to form and protect three dimensional structures, drape of a garment and make more suitable areas problem to additional carrying tension such as neck lines, facing, waist bands, placket, cuff, pocket flap and button hole of the leather garments [8, 9]. Although there are countless evaluations on the qualities and overall performance of a range of fusing materials and providers have a tendency to advocate one kind of reinforcement or any different for a particular implementation, deciding on a proper type of fusible interlining is then again generally based totally on trial and error method as properly as previous experience [10]. Yoon et al 2010 have used the Taguchi approach to make bigger a manner for optimizing the reinforcing materials to maximize the bond electrical energy amongst a fabric and fusible interlining [11]. A remarkable fused composite can be made when an appropriate fusing materials is selected for a certain particular cloth and chosen fusing stipulations are decided with an appropriate fusing materials that is managed exactly [12]. Many researches have been carried out various study including the compatibility of upper leather and fusible interlining materials. To the great of our knowledge, there is no lookup associated to overall performance traits of cotton pasting, tc pasting, polyester pasting fusible interlinings with goat nappa leathers. Since sheep nappa calfskins are broadly utilized for clothing applications [13].

The current work approximately is pointed at exploring the effect of reinforcing materials on chosen features of goat nappa calfskins with respect to their substantial checking out properties. The outcomes from this study could shape a foundation for deciding on suitable interlinings for fabrication of leather-based apparel.

2. Materials and Method

Conventional goat nappa leathers (B grade) were purchased with an mean size of 8±0.5 ft^2 from local market in Bangshal, Dhaka. They were selected in such a manner; they had a reasonably uniform thickness and size. Five skins were taken from a lot which were designated as S1, S2, S3, S4 and S5. Three different types of interlinings designated as F1, F2 and F3 were selected and their identification are given in Table 1. Fusing of upper leather and interlinings was

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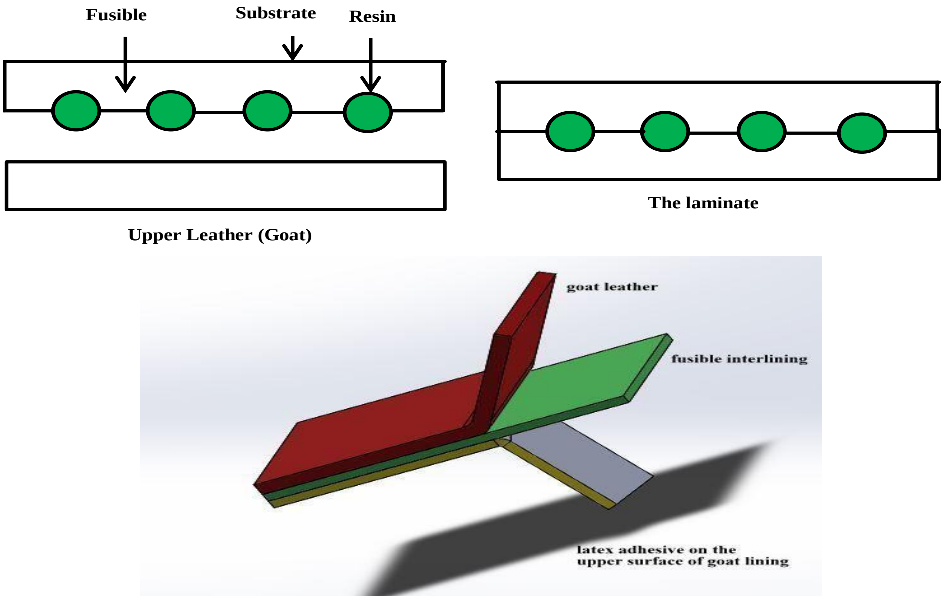


Fig.1 Photographic view of fusing process

Table 1 Identification of the reinforcing material

	F1	F2	F3
Type of interlinings	TC Pasting (Nonwoven)	Cotton Pasting (Nonwoven)	Polyester Pasting (woven)
Weight (GSM)	15.7	23.4	18.8
Thickness (mm)	0.055	0.072	0.065
Fiber content	100% Cotton	100% Cotton	100% Polyester

carried out using a fusing press machine (Straight linear fusing press HP 900LF) at Royal Footwear Industries Limited, Gazipur, Dhaka. Fusing parameters were made uniform after preliminary tests such as temperature of 150ºC, weight of 2bar and duration 15 seconds. Interlinings were intertwined to the calfskin specimen and conducted to standard testing strategy to assess their properties in terms of tensile strength, bond strength, double hole stitch tear strength, single age tear load and bursting strength.

2.2 Physical Characteristics Determination

Fusible interlining which exhibits the most essential property of the leather garments. Due to the change of physical and mechanical properties of reinforcing materials. Style properties, utility properties and durability all are composed of physical properties of fusible interlinings which helped to select appropriate fusible interlinings for the substrate materials.

2.2.1 Tensile strength (TS)

Tensile strength was measured according to ISO standard 3376 and using machine SATRA STD 172 simple tensile tester [14]. Dumbell shape with proper dimension specimens were cut for determining tensile strength. The test was carried out using SATRA machine with load cell capacity of 150lb and extension 100%. The test specimen were clamped between the jaws in 10 cm apart and ensured its grain surface lies in one plane. Until the sample was broken, the machine was run at a rate of 100±2mm/min steadily. The maximum force reached was recorded when the sample was subjected to breaking. Determine tensile strength dividing the highest force by the area of cross section.

2.2.2 Bond strength (BS)

Bonding strength is the strong capacity between the fusible lining materials and the upper which is assessed after assembling. It was tested as per reference SATRA TM 401(1992) [15]. A 70mm x 50mm strip of leather and interlining were cut and a paper for a length of 2.5mm was placed in between the two fabrics at one end of the sample so that a section of the material was not fused. The whole assembly was later fused and allowed to cool for 24 hours. The lower clamp was set at distance of 25mm from the upper clamp. The unfused leather end was clamped in the upper clamp and the other end was fixed in the lower clamp of the tensile testing machine in a particular manner that the lengthwise axis of the sample creates a right angle with the halted clamping surface. The experiment was handled at the velocity of 100±20 mm/min and the unfused ends in the machine grips were pulled apart. The force needed to pull the two fabrics apart was recorded.

2.2.3 Double hole stitch tear strength (DHSTS)

Double hole stitch tear force was decided under the universal standard: ASTM D 4705-00 [16]. Specimen is a rectangle of leather 50mm in length and 25mm in width with two holes 2mm in diameter on one end of the specimen. The center of the hole is 6 mm from the end and 6 mm apart and equidistant from the middle line of the sample. U shape 6 mm diameter wire was pass through the holes of the sample as if both ends estimate from the flesh side of the sample piece. Both ends of the wire are clamped in one grip of the experiment machine and the loosely ends of the sample in the rest of grip of the machine. Until the specimen tears, The machine was handled at a speed of 250mm/min. At the instant when the specimen begins to tear, load registered by the machine is recorded.

2.2.4 Single edge tears strength (SETS)

Single edge tear strength was determined according to international standard: ISO 3377-1: 2002 [17]. The sample is a rectangle of leather 70mm in length and 40mm in width. The specimen was set between the jaw of the tensile testing machine (SATRA STD 172) 50mm apart and clamped around 20mm of one leg of the sample in the lower jaw of the machine. Another leg of the specimen was folded along 180º and clamped in the upper jaw. The long edges of the sample piece are parallel to the machine, it was ensured during the experiment. Recorded the force extension plot until the piece in torn apart when the machine was run at the velocity of 100±2mm/min.

2.2.5 Bursting strength (BS)

Bursting strength was determined according to IS03379:1976 using SATRA STM 463 Digital Lastometer as shown in Figure 1 [18]. Circular test specimen of 44.5mm diameter is clamped firmly on the test machine. The specimen was clamped grain side up on all sides of the edge and is slowly distended forcing a small metal ball connected to a plunger along the sample at a rate of 0.20± 0.05 mm/s. At particular flatulence measured in respect of length passage by the plunger, splits show up within the surface of the fabric or a lower strip of the fabric supports physical harm; this distension is reported as the primary harm point. Finally, the maximum distension of the material can also be recorded as a bursting force.

3. Results and Discussions

Examining the features of a fused composite regularly provides a challenging project due to the fact its properties rely upon a range of outside fabrics, choice of fusing reinforcement and fusing specification. The outcomes of this learn about current beneficial facts in leather apparel manufacturing as well as apparel appearance.

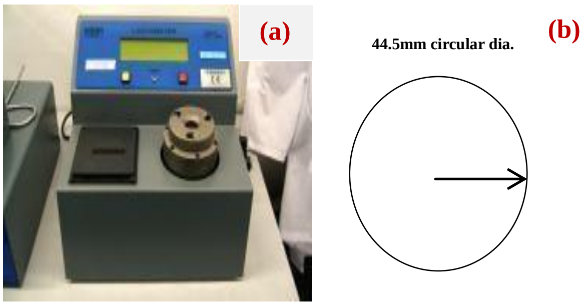


Fig.2 Specimen size (b) and SATRA STM 463 Digital Lastometer Tester (a).

3.1 Tensile strength

Tensile strength is a vital feature which indicates the strength and function of the material. Tensile energy of a material expresses the maximum amount of force it can be applied to prior than it conducts to failure. The measurements of tensile strength of control and fused composites are given in Table 2 for parallel and perpendicular to the backbone respectively. Among the fused composites calf skin fused with fusing F3 has the maximum tensile strength value in contrast to F1 and F2 and the cutting direction parallel to the backbone.

Table 2 Tensile strength (N/mm^2) of control leather and fused composites.

Parallel to the Backbone Direction				
Skins	Control leather	Fused leather composites		
		F1	**F2**	**F3**
S1	10.8	13	14.7	21.7
S2	10.3	11.8	13.8	17.1
S3	10.5	12	14.18	17.52
S4	9.8	10.9	13.6	16.9
S5	11.2	13.4	14.5	19.2
Perpendicular to the Backbone Direction				
S1	16.6	14.8	18.8	18.7
S2	13.3	12.4	14	17.8
S3	9.97	11.28	12.64	16.86
S4	14.4	14.2	14.3	18.4
S5	13.9	10.5	13.2	17.2

The reason for exhibit high tensile energy of polyester fused leather composites is that when it is subjected to tensile fatigue, the loops existing in the weaving structure will originally prolong in the path of load thereby main to untwisting of yarns. Further loading consequences in rupture of these fibers thereby propagating fracture of fabric. Therefore the load required to purpose breakage of fabric is high compared to the fused composites F1 and F2. In the case of nonwoven F1 and F2, the fabrics are created by way of mere bonding of fibers via mechanical, thermal or chemical processes. Hence when these composites are subjected to tensile loading, the fracture of interfiber bonds take region at very low stress itself thereby causing a rearrangement of fiber orientation. This leads to a decrease in tensile strength. Since, In case of goat skin the fibers are firmly oriented in parallel to the backbone as contrast to the perpendicular to the backbone and during test the percentage of extension was lower than perpendicular samples [21].

3.2 Bond strength

The bonding force of fusing materials is the most vital features which impact the quality of the product. The salient purpose of this experiment is to know about the mechanical strength of the resin film between leather and fusing materials as a reinforcement. The strength of the connection relies up on the adhesive forces between the cloth and adhesive. The pre-requisite for bonding force of a fusing material of leather is 0.5N/mm as per

SATRA TM 401. Results of the research work as shown in Table 3 indicated that bond strength of fused composite F3 has values within the range of 0.80 to 0.92 N/mm which is substantially higher than that of F1 and F2.

Table 3 Bond strength (N/mm) of fused composites.

Parallel to the Backbone Direction			
Skins	**F1**	**F2**	**F3**
S1	0.09	0.32	0.92
S2	0.11	0.41	0.82
S3	0.10	0.47	0.90
S4	0.13	0.28	0.88
S5	0.16	0.42	0.83
Perpendicular to the Backbone Direction			
S1	0.17	0.44	0.88
S2	0.13	0.55	0.80
S3	0.11	0.46	0.86
S4	0.08	0.43	0.85
S5	0.12	0.40	0.91

The main reason of infiltration of the resin into the structure of composite material is more in F3 interlining, as a result of deeper and a greater contact area of fusing materials. So, enough strength is needed to failure of bonds and hence the bond force is high. Comparatively minimum change in bonding force is observed for samples fused with F1 fusing materials, this happening because of scouring interlining surface. Besides that, a large change occurs in the bonding force of the samples which fused with F2 and it would be due to the out looking of shear situation between surfaces.

3.3 Double hole stitch tear strength

This experiment becomes popular due to a small amount of leather is needed to make this test and the procedure is easy. During the experiment, the force is applied to perpendicular to the sample and fibers. In Table 4, the double hole stitch tear force of control goat nappa leather and fused leather composites of parallel and perpendicular to the backbone is shown. It is seen from the effects that the double hole stitch tear force of fused leather composites F3 is maximum contrast to F1 and F2 both parallel and perpendicular to the backbone. The reason being F3 interlining is polyester woven base fabric which is responsible for significant stitch tear strength property [19]. Here also seen that the fused composites F3 prevails the maximum as shown for the samples cut parallel to the backbone with a percentage increment 64.54, while there is a 4.11% rise for F1 and 21.01% for F2.

3.4 Single edge tear strength

Single edge tear strength is also an essential property for apparel leather garments. During this test, the test specimen is parallel to the direction of the machine. In Table 5, the single edge tear force of control goat nappa leather and fused leather composites is shown when test is carried out parallel and perpendicular to the backbone.

Table 4 Double Hole Stitch Tear force (N/mm) of control goat nappa leather and fusing materials.

Parallel to the Backbone Direction				
Skins	Control leather	Fused leather composites		
		F1	**F2**	**F3**
S1	92.83	93.51	124.72	161.54
S2	86.62	83.76	88.44	119.83
S3	78.26	89.15	113.81	141.96
S4	55.55	64.63	66.13	102.77
S5	74.67	72.82	76.33	112.21
Perpendicular to the Backbone Direction				
S1	104.81	111.72	138.52	164.48
S2	59.32	72.81	102.11	107.15
S3	115.72	100.73	124.63	134.08
S4	95.29	108.63	123.18	143.82
S5	62.78	66.37	94.27	122.42

Table 5 Single edge tear strength (N/mm) of control goat nappa leather and fused leather composites.

Parallel to the Backbone Direction				
Skins	Control leather	Fused leather composites		
		F1	**F2**	**F3**
S1	19.23	20.21	26.57	23.09
S2	18.32	18.11	22.88	21.71
S3	18.5	19.06	23.17	22.67
S4	15.87	12.08	24.62	19.87
S5	13.45	17.75	18.72	20.88
Perpendicular to the Backbone Direction				
S1	19.37	23.01	27.88	25.21
S2	18.72	19.72	25.67	21.77
S3	20.83	21.5	24.45	23.25
S4	15.55	16.05	23.92	18.82
S5	17.62	13.88	21.34	19.75

From the table, it seems to be mind that fused leather composites F2 shows higher strength compared to fused composites F1 and F3.

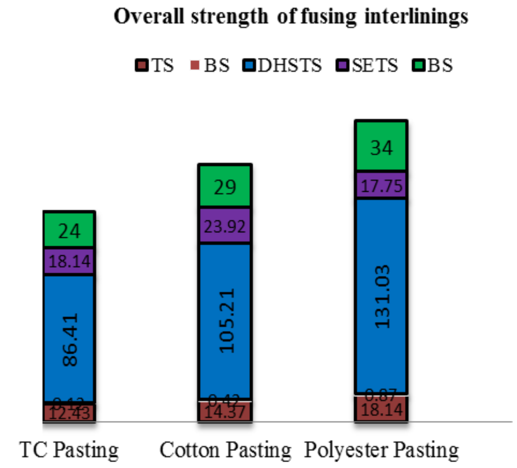
3.5 Bursting strength

From the outcomes shown in Table 5, it is observed that fused leather composite F3 has high bursting strength contrast to F1 and F2. This is because F3 has excessive weight and thickness in contrast to F1 and F2 which is accountable for high bursting strength [20]. When load is applied multi-directionally on fused composite F3, first loops lengthen and similarly loading untwists the yarns leading to material breakage with a massive sound. When load is applied on bonded fibers in fused composites F1 and F2, it burst without problems due to the fact the fibers are held basically via frictional contact.

Table 6 Bursting Strength (kg/cm2).

Sample Name	Applied Load(Kg)	Extension (mm)	Bursting Strength(Kg/cm^2)
Control	27	11.5	20.5
FLC* F1	24	10.00	24
FLC* F2	29	10.00	29
FLC* F3	41	11.00	34

*FLC – Fused Leather Composites



All features related to fusing materials is identified, it is clear that fusible interlining, polyester pasting performed well in the areas of tensile strength, double hole stitch tear strength and bursting strength both parallel and perpendicular to the backbone. Tc pasting has good bond strength but overall strengths are better in polyester pasting.

4. Conclusion

Interlinings applied for clothing must have required comfort and physical features. In the current study, goat nappa garment leathers had been fused with three interlining materials. Of all the elements of performance investigated, it is clear that fusible interlinings F3 performed nicely in the areas of tensile strength, bond strength, double hole stitch tear strength and bursting strength whereas fusible interlinings F2 exhibits higher performance in case of single edge tear strength. Finally, we can say that the overall performance is better for polyester interlinings. The reason behind F3 is a woven based interlining that has led to an enhanced and great performance which outbreak manufacturer's recommendation for decision of interlining which is no longer a reliable predictor of performance. Future research would be concentrated upon other types of leathers and interlinings which will be carried out to determine whether the bought consequences can be generalized to specific structure of fusible interfacings.

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