International Journal of Advance Research in Science and Engineering
Vol. No.4, Issue 09, September 2015
www.ijarse.com
IJARSE
ISSN 2319 - 8354

EFFECT OF APPLYING FLOCKING METHOD ON THE ABRASION PROPERTIES OF SELECTED UPHOLSTERY FABRICS

Gamal Mohamed Radwan[1], Eman Zaher Goda[2]

[1]Assistant Professor , [2]Demonstrator

Spinning, Weaving and Knitting Dept., Faculty of Applied Arts

Helwan University

ABSTRACT

Flocked fabrics are particularly used in outwear and home upholstery since they are comfortable and soft. In this study, Martindale abrasion of the flocked fabrics was investigated.The produced fabrics differ from each other infloat length, weft yarns materials and flocking ratios.The received results demonstrate that, the float length has a direct proportional relationship with fabric abrasion resistance in flocked fabrics but has an inverse proportional relationship with fabric abrasion resistance in fabrics without flock. Also,the received results demonstrate that the fabrics produced from Polyester have recorded the highest values in abrasion resistance and the flocking ratio has a direct proportional relationship with abrasion resistance.

Keywords: Flocked Fabrics, Abrasion Resistance, Float Length, Flocking Ratio.

I INTRODUCTION

Flocking is a process of applying short fibers – called flock – to an adhesive coated surface [1, 2]. The flock can cover either the entire surface area or it can be printed onto the surface area in a pattern of some sort to make a design [1].The basic elements of the flocking structure are composed of: (A substrate - An adhesive - Flock fibers) [3, 4].

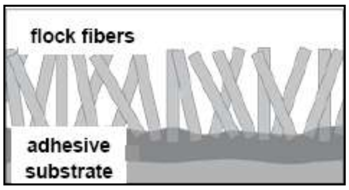


Figure (1) Flock Fibers are stuck to the Substrate Surface by an Adhesive

The principle of flocking can be arranged in the following operations as follows:[3]

1. Laying of the adhesive composition on the substrate surface through a stencil, or in another meaning coating the substrate surface with the adhesive[3, 5].

2. Flocking which is the process of distribution of the flock fibers in the adhesive layer on the substrate surface.
3. Removal of the flock remnants from the surface, which have not consolidated their hold.
4. Drying and fastening of the flock on the adhesive layer in a hot air oven [3, 6].

The flocking process is used on items ranging from retail consumer goods to products with high-technology military applications[7, 8]. Flocked products are used in numerous applications, which must withstand daily heavy use. Fiber used for flocking can be made from any generic material. It can be made from natural fibers (Cotton), regenerated fibers (rayon viscose) or synthetic fibers (Polyamide {Nylon}, Polyester, Poly Acrylic and Olefins) [9].The diameter of flock fiber is only a few thousandths of centimeter and it ranges in length from 0.5 to 2.0 mm. Its fineness can be 14 micron [4, 10]. The choice of the adhesive is considered to be of paramount importance[11]. The proper application of the adhesive is the most important part of the process. Without the correct type of adhesive a permanent binding between substrate and flock cannot take place [9].The process of flocking is firmly simple and easy and it can be done by means of different technologies [3, 12]. Flock image can be obtained electrostatically and mechanically, or by a combination of both techniques. In both processes the flock is placed in an erect position, and after flocking, the fabric is dried and then cured in hot-flue oven or chamber at 1500C for 5 minutes [13, 14]. Flock fabric in daily use has some problems. There is a tendency of delaminating of the flock fiber layer from the substrate under the rubbing and abrasion movements in cleaning and general use. Studies about the abrasion behavior of flocked fabrics are limited. The aim of this study was characterize certain flocked fabrics by measuring the abrasion resistance. For this purpose, Martindale abrasion behavior of flocked fabrics was determined.

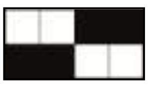
II EXPERIMENTAL WORK

This research is concerned with studying the effect of applying flocking method on the abrasion properties of selected upholstery fabrics. In this research 27samples were produced according to 3 parameters.

2.1 The parameters used for producing the samples under study.

2.1.1 First parameter: **Fabric structure**, this parameter consists from three levels.

I. **Plain weave 2/2:**this structure is repeated on 2 picks as shown in fig (4.a).
II. **Plain weave 4/4:**this structure is repeated on 4 picks as shown in fig (4.a).
III. **Plain weave 6/6:**this structure is repeated on 6 picks as shown in fig (4.a).



Figure(2) Plain weave 2/2

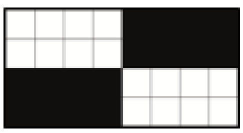


Figure (3) Plainweave 4/4

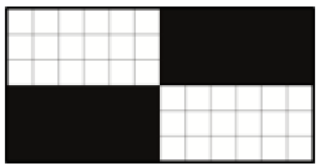


Figure (4) Plain weave 6/6

2.1.2 Second parameter: Weft yarns materials, this parameter contains three different materials (Cotton – Polyester – Poly acrylic) with linear density 12/1 Ne.

2.1.3Third parameter: Flocking ratio, this parameter contains three ratios of flock on the fabric (0 % - 33 % - 66 %).

Table (1): Parameters used for producing the samples under study.

Samples	Parameters		
	Fabric structure	**Weft type**	**Ratio of the flock (%)**
Sample No. 1	Structure (A) plain weave 2/2	Cotton 12/1 Ne.	0 %
Sample No. 2			33%
Sample No. 3			66%
Sample No. 4		Polyester 12/1 Ne.	0%
Sample No. 5			33%
Sample No. 6			66%
Sample No. 7		Poly acrylic 12/1 Ne.	0%
Sample No. 8			33%
Sample No. 9			66%
Sample No. 10	Structure (B) plain weave 4/4	Cotton 12/1 Ne.	0%
Sample No. 11			33%
Sample No. 12			66%
Sample No. 13		Polyester 12/1 Ne.	0%
Sample No. 14			33%
Sample No. 15			66%
Sample No. 16		Poly acrylic 12/1 Ne.	0%
Sample No. 17			33%
Sample No. 18			66%
Sample No. 19	Structure (C) plain weave 6/6	Cotton 12/1 Ne.	0%
Sample No. 20			33%
Sample No. 21			66%
Sample No. 22		Polyester 12/1 Ne.	0%
Sample No. 23			33%
Sample No. 24			66%
Sample No. 25		Poly acrylic 12/1 Ne.	0%
Sample No. 26			33%
Sample No. 27			66%

2.2Specifications (Machine and fabrics)

I. The specification of the machine used in producing the samples:

1- Type of the machine: Rapier
2- Width of warp without selvedge: 140 cm
3- Speed of the machine: 300 picks per minute
4- Reed used (dents per cm): 9 dents per cm
5- Denting: 8 ends per dent

II. The specifications of the produced fabrics:

1-	Warp type:	Polyester
2-	Weft type:	Cotton, Polyester, Poly acrylic
3-	Count of warp yarns:	150 denier
4-	Count of weft yarns:	12/1 Ne.
5-	Warp sett (end per cm):	72 ends per cm
6-	Weft sett (end per cm):	19 picks per cm
7-	Weave structure:	Plain weave derivatives

2.3 Laboratory tests applied to samples under study

Abrasion resistance test:

The test was done according to American standard specifications of (ASTM-D-4966) [15].

The Sleeted Flock Designs:

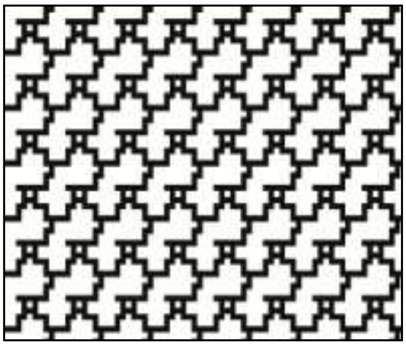


Figure (5) Flocking Design with the Ratio 33 % (Black Colour)

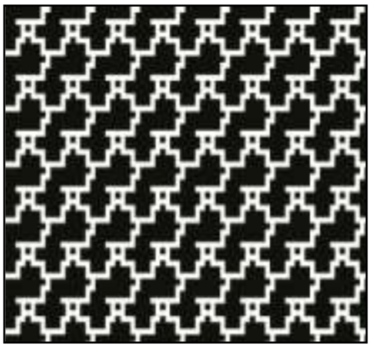
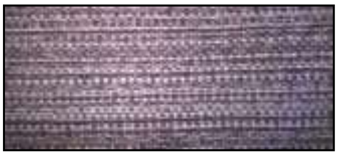
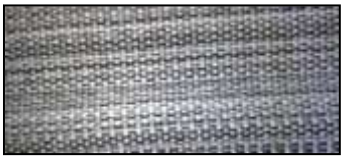
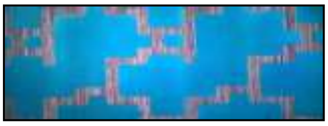
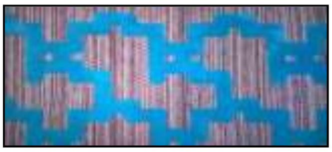
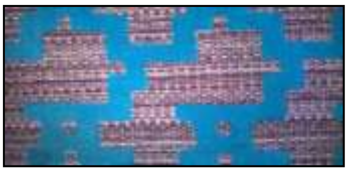


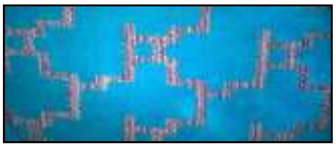
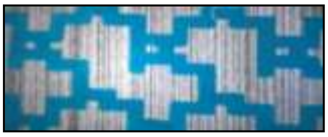
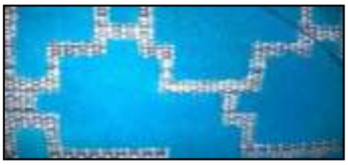
Figure (6) Flocking Design with the Ratio 66 % (Black Colour)

Pictures of Selected Produced Samples:

Sample No.	Weave Structure	Weft Yarn Material	Flocking Ratio
 Figure (7)Sample (7)	Plain Weave 2/2	Poly acrylic	0%

International Journal of Advance Research in Science and Engineering
Vol. No.4, Issue 09, September 2015
www.ijarse.com
IJARSE
ISSN 2319 - 8354

 **Figure (8)Sample (25)**	**Plain Weave 6/6**	**Poly acrylic**	**0%**
 **Figure (9)Sample (10)**	**Plain Weave 4/4**	**Cotton**	**0%**
 **Figure (10)Sample (22)**	**Plain Weave 6/6**	**Polyester**	**0%**
 **Figure (11)Sample (23)**	**Plain Weave 6/6**	**Polyester**	**33%**
 **Figure (12)Sample (9)**	**Plain Weave 2/2**	**Poly acrylic**	**66%**
 **Figure (13)Sample (17)**	**Plain Weave 4/4**	**Poly acrylic**	**33%**
 **Figure (14)Sample (15)**	**Plain Weave 4/4**	**Polyester**	**66%**
 **Figure (15)Sample (26)**	**Plain Weave 6/6**	**Polyester**	**33%**

 **Figure (16)Sample (27)**	**Plain Weave 6/6**	**Polyester**	**66%**
 **Figure (17)Sample (14)**	**Plain Weave 4/4**	**Polyester**	**33%**
 **Figure (18)Sample (24)**	**Plain Weave 6/6**	**Polyester**	**66%**
 **Figure (19) Sample (3)**	**Plain Weave 2/2**	**Polyester**	**66%**
 **Figure (20) Sample (2)**	**Plain Weave 2/2**	**Polyester**	**33%**

III RESULTS AND DISCUSSIONS

The produced fabrics in this research were tested for some essential functional properties which reflected to their end uses.Table (3-10) shows the percentages of weight loss after 3000 cycles of abrasion applied to the produced fabrics.

Table (2) Percentages of Weight Loss after 3000 Cycles (%)

	Structure (A)			**Structure (B)**			**Structure (C)**		
	Cotton	**Polyester**	**Poly acrylic**	**Cotton**	**Polyester**	**Poly acrylic**	**Cotton**	**Polyester**	**Poly acrylic**
Without flock	3.54	3.02	3.07	5.89	4.43	7.60	9.22	7.41	9.29
33% flock	0.56	0.51	0.54	0.52	0.45	0.49	0.46	0.40	0.43
66% flock	0.41	0.27	0.41	0.33	0.24	0.29	0.21	0.16	0.28

- Structure (A): plain weave 2/2.
- Structure (B): plain weave 4/4.
- Structure (C): plain weave 6/6.

Table (3) Regression Equation and Quadratic Coefficient for the Effect of Flocking Ratio on Fabric Abrasion Resistance for Produced Samples in Structure (A)

Weft Yarn Material	Regression Equation	R^2(Quadratic Coefficient)
Cotton	y = -4.7424x + 3.0683	R^2 = 0.7859
Polyester	y = -4.1667x + 2.6417	R^2 = 0.8149
Poly acrylic	y = -4.0303x + 2.67	R^2 = 0.7866

Table (4) Regression Equation and Quadratic Coefficient for the Effect of Flocking Ratio on Fabric Abrasion Resistance for Produced Samples in Structure (B)

Weft Yarn Material	Regression Equation	R^2(Quadratic Coefficient)
Cotton	y = -8.4242x + 5.0267	R^2 = 0.7756
Polyester	y = -6.3485x + 3.8017	R^2 = 0.7875
Poly Acrylic	y = -11.076x + 6.4483	R^2 = 0.7705

Table (5) Regression Equation and Quadratic Coefficient for the Effect of Flocking Ratio on Fabric Abrasion Resistance for Produced Samples in Structure (C)

Weft Yarn Material	Regression Equation	R^2(Quadratic Coefficient)
Cotton	y = -13.652x + 7.8017	R^2 = 0.7708
Polyester	y = -10.985x + 6.2817	R^2 = 0.7748
Poly acrylic	y = -13.652x + 7.8383	R^2 = 0.7625

From the statistical analysis of the results of abrasion test, the regression equation and quadratic coefficient was obtained to determine the relationship between fabric abrasion resistance and flocking ratio. It was found from tables (3-11), (3-12) and (3-13) that there is a strong relationship between fabric abrasion resistance and flocking ratio. This means that as the flocking ratio increase, the fabric abrasion resistance also increases.

3.1 Effect of Structure (Float Length) on Fabric Abrasion Resistance

3.1.1Fabric without Flock:

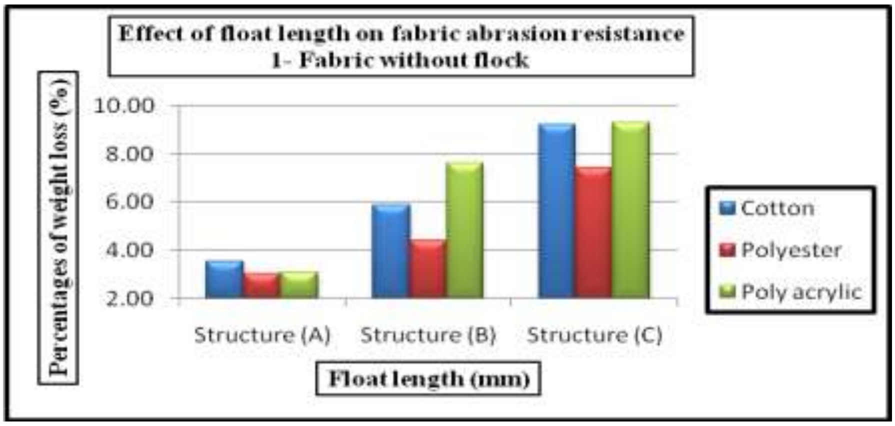


Figure (21) Relationship between Float Length in Fabric without Flock and Fabric Abrasion Resistance

Tables (3-11), (3-12) and (3-13) and figure (3-7) show that there is an inverse proportional relationship between float length and fabric abrasion resistance. This could be explained that the increase in the float length increases the areabetween the weft yarn and the abrading so this can increase weight loss because of the rubbing cycles and this leads to decrease the fabric abrasion resistance.

3.1.2Flocked Fabric:

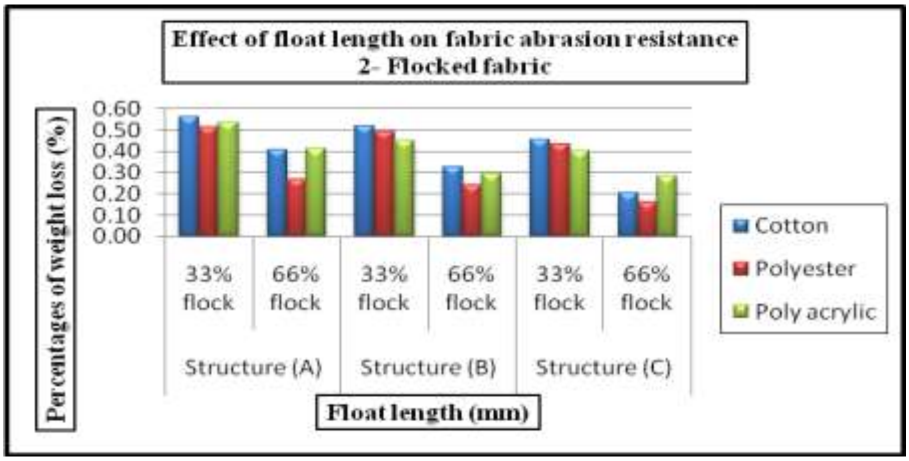


Figure (22) Relationship between Float Length in Flocked Fabric and Fabric Abrasion Resistance

Tables (3-11), (3-12) and (3-13) and figure (3-8)show that there is a direct proportional relationship between float length and fabric abrasion resistance. Thiscould be explained that the increase in the float length increases the amount of adhesive absorbed by the fabric which leads to accept more flock fibers so the fabric will take more time to abrade. For this reason the fabric abrasion resistance increased.

3.2Effect of Material Type on Fabric Abrasion Resistance:

3.2.1Fabric without Flock:

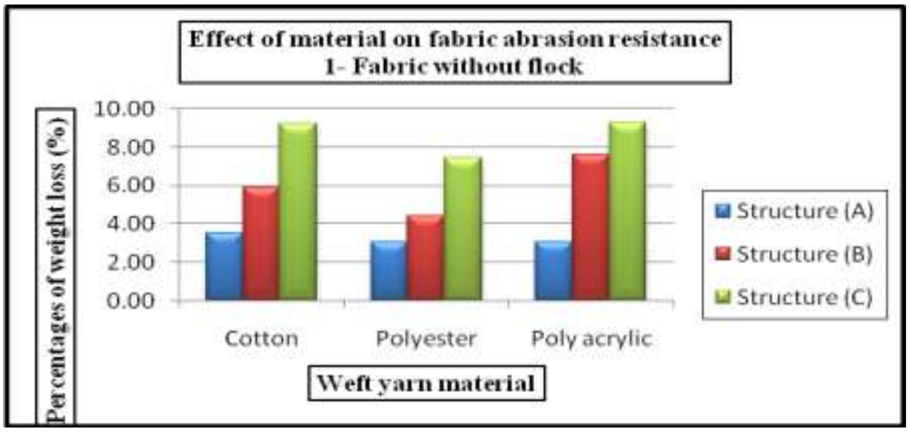


Figure (23) Relationship between Weft Yarns Material in Fabric without Flock and Fabric Abrasion Resistance

It can be noticed from tables (3-11), (3-12) and (3-13) and from figure (3-9)thatweft yarn material has a significant effect on fabric abrasion resistance. It can be observed that fabrics produced from Polyester weft yarn

IJARSE
ISSN 2319 - 8354

recorded the highest values in abrasion resistance. This could be explained that Polyester fibers have high tenacity than other materials.

3.2.2Flocked Fabric:

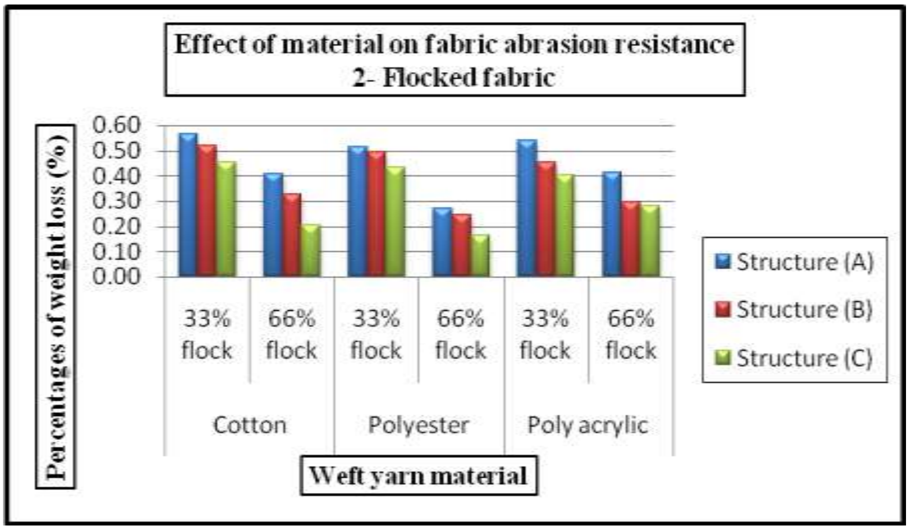


Figure (24) Relationship between Weft Yarns Material in Flocked Fabric and Fabric Abrasion Resistance

In general, tables (3-11), (3-12) and (3-13) and figure (3-10)show thatfabrics produced from Polyester weft yarn recorded the highest values in fabrics abrasion resistance for almost fabrics, this may be attributed to the tenacity of Polyester fibers that increase abrasion resistance.

3.3 Effect of Flocking Ratio on Fabric Abrasion Resistance:

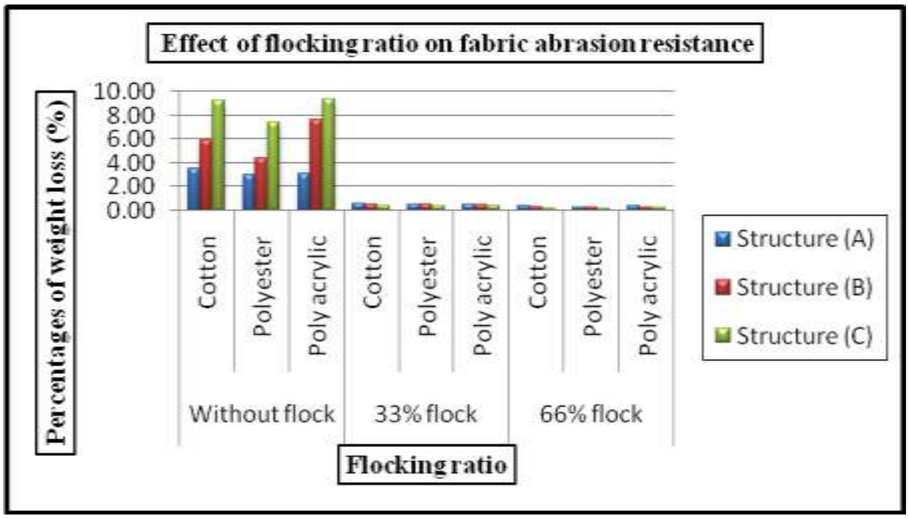


Figure (25) Relationship between Flocking Ratio and Fabric Abrasion Resistance

Tables (3-11), (3-12) and (3-13) and figure (3-11)show that there is a strong direct proportional relationship between flocking ratio and fabric abrasion resistance. It is obvious fabric abrasion resistance was increased in flocked fabrics more than fabrics without flock, or in other words, using the flocking method improves the fabric abrasion resistance. This may be attributed to the following reasons:

1- The flocking process added a layer of adhesive and flock fibers over the fabric surface which led to increase the fabric abrasion resistance.
2- The increase in the flocking ratio increases the area of the fabric covered with adhesive and flock fibers and that lead the fabric take more time to abrade as a result the fabric abrasion resistance increases.

IV CONCLUSIONS

It was concluded that the float length has a direct proportional relationship with fabric abrasion resistancein flocked fabrics but has an inverse proportional relationship with fabric abrasion resistance in fabrics without flock.

It was concluded that the fabrics produced from Polyester have recorded the highest values in abrasion resistance.

It was concluded that the flocking ratio has a direct proportional relationship with abrasion resistance.

References

[1].Phyllis G.Tortora, Understanding Textiles, Collier Macmillan Publishers, London, (1978), pp.297-298.

[2].Joseph Burkhart, Chris Piacitelli, Diane Schwegler-Berry, William Jones, Environmental Study Of Nylon Flocking Process, Journal of Toxicology and Environmental Health, Part A, 57:1–23, (1999).

[3].S.Havenko, O.Mmizuk, R.Rybka,E.Kibirkstis, L.Zubrickaite, Study of Physical Aspects of Electroflocking (Flock Printing), ISSN 1392–1320 Materials Science (MEDŽIAGOTYRA). Vol. 13, No. 3.(2007), pp.206, 209.

[4].K.Bilisik, Y.Turhan, O.Demiryurek, Tearing Properties of Upholstery Flocked Fabrics, Textile Research Journal,Vol. 81(3), (2011), 290–300.

[5].K.Bilisik,G.Yolacan, Abrasion Properties of Upholstery Flocked Fabrics, Textile Research Journal, November (2009), Vol. 79(17): 1625–1632.

[6].Aigle: Best solutions for coating flocking, lamination and coagulation, Pakistan Textile Journal, April (2011).

[7].Y.K.Kim,A.F.Lewis, Scientific Study of Flock Materials and the Flocking Process, National Textile Center, Annual Report: November (2008), F97-D01,pp.1-3.

[8].http://www.infind.com.au/coatings1.html, web page (February 2013).

[9].Flock, More And More Part Of Our Daily Living Scene, cited from http://www.mutimex.co.za/principals/velutex/index.asp, web page (July 2012).

[10].Understanding the Flocking Process, cited from http://www.swicofil.com/flock.html, web page (December 2011).

[11].http://www.flocking.biz/flock_adhesives.html, web page (December 2011),

IJARSE
ISSN 2319 - 8354

[12]. http://www.flocking.biz/process.html, web page (December 2011).

[13].Sara J. Kadolph, Textiles, Pearson Prentice Hall, 10th Ed. (2007), PP.310-311.

[14].http://blogs.siliconindia.com/Nilesh/Flock_Printing-bid-vPXsLn0471514229.html, web page (February 2013).

[15].34. ASTM-D-4966, Standard test method for abrasion resistance of textile fabrics.