WU4/G/211

SAWTRI TECHNICAL REPORT

No. 493

Spinning and Weaving of DREF Yarns having Speciality Fibres on the Surface

by
G.A. Robinson, L. Hunter and H. Taylor

SOUTH AFRICAN
WOOL AND TEXTILE RESEARCH
INSTITUTE OF THE CSIR

P.O. BOX 1124
PORT ELIZABETH
REPUBLIC OF SOUTH AFRICA

ISBN 0 7988 1972 3

SPINNING AND WEAVING OF DREF YARNS HAVING SPECIALITY FIBRES ON THE SURFACE

by G.A. ROBINSON, L. HUNTER and H. TAYLOR

ABSTRACT

The novel feature of the DREF Mk II open-end spinning machine, which enables the radial positions of the fibres in the yarn cross-section to be pre-determined, has been used to show how a speciality fibre such as camel hair or mohair can be made to predominate on the yarn surface whilst a cheaper fibre makes up the body of the yarn. In this manner the yarn, and subsequent fabric, have the aesthetic qualities of the speciality fibre in spite of the fact that it only makes up a small proportion of the whole.

INTRODUCTION

The DREF Mk II open-end spinning system made its commercial debut some six years ago. The system is mainly suitable for spinning coarse yarns (≈200 to 3 000 tex) at high speeds directly from card sliver. It is claimed[1] that this system lends itself to the spinning of almost any type of fibre, both with or without a core yarn. Possible end-uses for Dref-spun yarns include blankets, upholstery, industrial fabrics, cleaning cloths, wall coverings, carpet backing, curtaining and in particular, carpets. Furthermore, fancy yarns can be spun by feeding slivers of different colours and types of fibre.

A unique feature of the DREF Mk II system is that it enables the radial position of fibres in the yarn cross-section to be pre-determined by changing the relative positions of the slivers as they are presented to the opening (card) roller. This report describes a series of experiments in which this unique feature was utilised to position a speciality fibre, e.g. camel hair, on the yarn surface and less expensive fibres in the yarn interior, thereby obtaining the desirable aesthetic characteristics of the former at a much lower cost.

EXPERIMENTAL AND DISCUSSION OF RESULTS

Initial Small-Scale Trials:

Preliminary experiments were carried out on various combinations of camel hair noils, carbonised wool noils, scoured kid mohair and merino wool, principally in an attempt to achieve a soft handle in a ladies outerwear cloth at a reasonable raw material cost. The experimental design is shown in Table I. It was decided to spin 250 tex yarns since finer yarns were found to give unacceptable fabrics.

TABLE I

EXPERIMENTAL DESIGN FOR SPINNING 250 TEX YARN

Experiment No.	Number of slivers supplied simultaneously*				Approximate composition of yarn (%)
	Camel hair noils (5 ktex sliver)	Carbonised wool noils (10 ktex sliver)	Scoured kid mohair (5 ktex sliver)	Wool tops (5 ktex sliver)	
1	2	1	4	—	50 mohair 25 wool 25 camel
2	2	1	2	2	50 wool 25 mohair 25 camel
3	1	—	2	1	25 wool 50 mohair 25 camel
4	—	2	1	1	75 wool 25 mohair
5	2	—	—	2	50 wool 50 camel

* The slivers were fed to the card roller in the same relative positions as they appear in the table (i.e. the camel hair noil slivers were on the left and the wool tops on the right *when facing the back of the machine.*

TABLE II

FIBRE PROPERTIES

Fibre Properties	Fibre			
	Camel Hair Noil	Carbonised Wool Noils	Fine Kid Mohair	Wool Top
Fibre Diameter (μm)	18,3	19,9	28,4	18,4
CV (%)	36	25	30	20
Fibre length (mm)	52	24	76	72
CV (%)	56	75	55	52

Fibre Properties

Table II shows the fibre properties of the raw materials used in the experiments.

Processing details

The fibres were carded on a Turner and Atherton card and the camel hair, mohair and wool tops were drawn on a cotton type Zinzer drawframe to reduce the sliver to 5,0 ktex. Because the carbonised wool noils were very short it was not possible to pass these through the drawframe and the 10 ktex card sliver was therefore used directly on the spinning machine. Spinning was carried out on a DREF Mk II open-end spinning machine at a card cylinder speed of 3 400 rev/min and a paradisc speed of 2 000 rev/min. Spinning details are given in Table III.

The slivers were fed to the DREF machine, their relative positions (see Table I) dictating which fibre would predominate on the surface of the yarn, with the fibres from the slivers on the left predominating on the yarn surface and those from the slivers on the right, predominating in the yarn core.

The camel hair noil slivers were fed on the left side in four out of five experiments since this would make the camel hair predominate on the yarn surface thereby fully utilising the desirable aesthetic characteristics of the soft camel hair.

No problems were experienced during the spinning of the small quantities of yarn required for subsequent weaving.

TABLE III

SPINNING DETAILS

Experiment No.	Feed (m/min)	Delivery (m/min)	Speed of perforated twisting rollers (rev/min)
1	0,78	80	995
2	0,62	80	950
3	1,0	80	950
4	1,38	80	950
5	1,00	80	950

Weaving and Fabric Evaluation

Fabric samples were woven on a handloom after which they were scoured and brushed. It was found that the fabrics produced in experiments 1 and 4 suffered relatively high fibre losses during brushing whereas fabric 5 suffered relatively little fibre loss. All the fabrics exhibited approximately the same shrinkage during washing, with the exception of the fabrics from experiment 1 which exhibited virtually no shrinkage. In experiments 1, 2, 3 and 5, the camel hair formed the bulk of the yarn surface, and therefore also on the fabric surface. Raising and cropping resulted in attractive fabrics with a soft handle.

Subjective evaluation of the fabrics and yarns together with the performance of the fabrics during brushing and washing indicated that a long carrier fibre or a core yarn was necessary for adequate yarn strength, weaving performance and fabric properties. The initial trials, however, were considered to be sufficiently promising to justify further trials on a larger scale.

Large Scale Trials

The experimental design selected for the large-scale trials is given in Table IV and details of the fibres are given in Table V. The camel hair noil, mohair noil and the carbonised short locks were carded on a Turner and Atherton card. The lambswool and Lincoln wool were obtained in top form. Lincoln wool was selected as the carrier fibre and was supplied to the spinning machine so that it predominated in the yarn core. Carbonised short locks were included in the trials because they are soft and relatively inexpensive. Three different types of fibres were selected as alternatives for the yarn surface, namely: camel hair noils, Noble combed mohair and lambswool.

Spinning details are given in Table VI. The machine settings for twist levels were arrived at by trial and error, based upon experience gained in exploratory small scale trials. Each blend (Table IV) was spun into 250 tex yarns. Each blend was spun with and without a 44 dtex nylon core. In the case of yarn No. 6 (camel — without core), two yarns were spun which differed in the amount of twist inserted, one to be used as warp and the other as weft.

Six warps of 760 ends over 107 cm were made. Sizing of the warp yarns was found to be necessary and each warp was sized using 5% ®Bevaloid 4032.

The yarns were woven on a Dornier Rapier loom GTN 6/SD into a 4 shaft satin/sateen check pattern with 7 ends and picks per cm to give a cloth of approximately 300 g/m^2.

All the fabrics were crabbed at 100° C for 20 min followed by scouring in a winch using 5% soda ash and 0,5% ®Ultravon HD at 45° C for 20 min. After rinsing for 30 min and drying in a stenter at 100° C to a width of 0,95 m, the fabrics were decatised (3 min steam, followed by a 5 min blow cool), raised on the

TABLE IV

EXPERIMENTAL DESIGN FOR SPINNING

Experiment	Relative Sliver Position*			Approximate Composition (%)
6	Camel hair noils	Carbonised short locks	Lincoln wool	67 wool 33 camel
7	Noble combed mohair noils	Carbonised short locks	Lincoln wool	67 wool 33 mohair
8	Lambswool	Carbonised short locks	Lincoln wool	100 wool

* Facing the back of the spinning machine

TABLE V

FIBRE PROPERTIES

Fibre properties	FIBRE				
	Camel hair noil	Mohair (Noble combed)	Lambswool	Carbonised short locks	Lincoln wool
Fibre Diameter (μm)	18,3	34,0	19,0	20,2	33,6
CV (%)	36	50	23	26	29
Mean Fibre Length (mm)	52,0	28,0	42,0	21,5	88,0
CV (%)	56	65	47	67	62

TABLE VI
SPINNING DETAILS

Surface fibre		Feed (m/min)	Delivery (m/min)	Speed of perforated twisting rollers (revs/min)
Without core	6. Camel (warp) (weft)	0,80 0,80	79 79	1590 1425
	7. Mohair	0,80	79	1750
	8. Lambswool	0,76	79	1350
With core	6c. Camel	0,85	79	1100
	7c. Mohair	0,85	79	1400
	8c. Lambswool	0,76	79	1100

Some of the physical properties of the various yarns are given in Table VII.

TABLE VII
YARN PROPERTIES

Yarn	Actual Yarn Linear Density (tex)	Breaking Strength (cN)	Tenacity (cN/tex)	Extension (%)	Irregularity (CV %)	Hairiness (hairs/m)
Camel without core — warp	252	545	2,2	15,4	10,0	123
without core — weft	224	372	1,5	21,8	10,7	153
with core	253	808	3,2	16,4	11,2	134
Mohair without core	259	330	1,3	24,4	10,5	292
with core	216	406	1,9	13,4	12,6	180
Lambswool without core	241	513	2,1	23,4	11,0	124
with core	242	702	2,9	13,6	10,9	118

face only and finally cropped back and face, and steamed.

The yarn properties are shown in Table VII. No direct comparisons can be made between the various yarns because of the variations in twist level which was necessary for the different blends. The core yarns had significantly higher tensile properties. The mohair yarns were the weakest, probably because the fibres were both short and coarse. The yarns had similar irregularities.

The core had no apparent effect on the fabric appearance but significantly improved weaving performance and the use of a core, possibly even coarser than that used here, is therefore recommended. Sample fabrics are shown in the Appendix.

SUMMARY

A novel feature of the DREF Mk II open-end spinning machine is that the radial distribution of fibres in the yarn cross-section can be pre-determined by their relative positions as they are presented to the opening roller. This feature has been used to advantage in this investigation to illustrate how a speciality fibre, such as camel hair, even though present in a relatively low proportion, can be made to predominate on the yarn surface, and therefore also the fabric surface, imparting to the fabric the aesthetic qualities of this fibre.

Successful trials were carried out in which 250 tex yarns were spun using a coarse long (34 μm, 88 mm) Lincoln wool as carrier fibre, short carbonised locks as a filler and either camel hair noils, Noble combed mohair noils or lambswool for the yarn surface. Yarns were spun with and without a nylon core and it was found that the nylon core, improved both spinning and weaving performance. The warp yarns were sized and then woven successfully into ladies' coating type of fabrics.

THE USE OF PROPRIETARY NAMES

The fact that products with proprietary names have been mentioned in this report does not in any way imply that SAWTRI recommends them or that there are not substitutes which may be of equal value or even better.

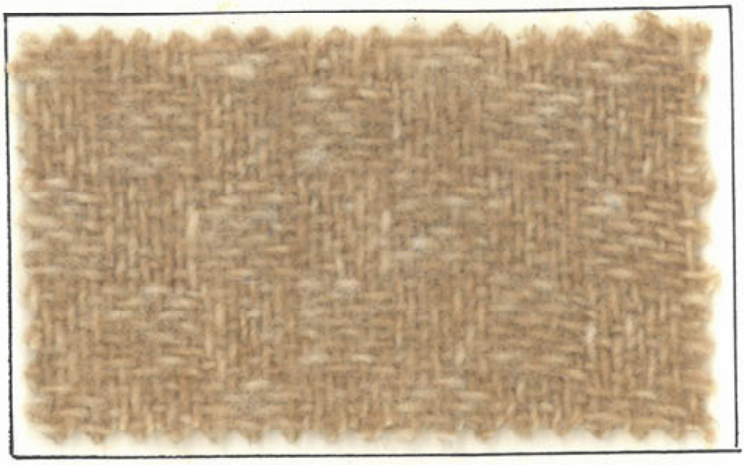
ACKNOWLEDGEMENTS

The authors wish to thank Dr D.W.F. Turpie for helpful advice, Mr H.H. Erdurson for technical assistance, Mr R. Ellis for weaving the fabrics and Mr E. Barchietto for finishing the fabrics. Thanks are also due to Messrs Stroud Riley (Pty) Limited for the use of their raising machine.

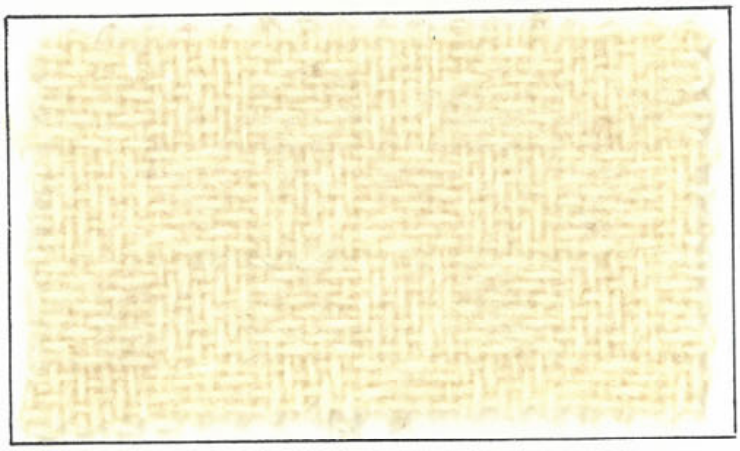
REFERENCES

1. Dr Ernest Fehrer, Textilmaschinen fabrik, Austria.

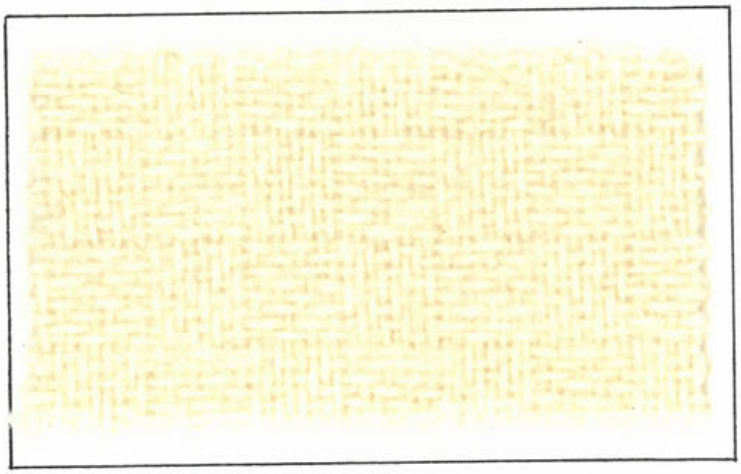
APPENDIX



33% Camel hair noils, 33% carbonised short locks and 33% Lincoln wools.



33% Mohair noils, 33% carbonised short locks and 33% Lincoln wools.



33% Lambswool, 33% carbonised short locks and 33% Lincoln wools

ISBN 0 7988 1972 3

© Copyright reserved

Published by
The South African Wool and Textile Research Institute
P.O. Box 1124, Port Elizabeth, South Africa
and printed in the Republic of South Africa
by P U D Repro (Pty) Ltd., P.O. Box 44, Despatch