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SOURCES OF FABRIC BARRÉ IN ROTOR YARN: Part 2

In the January issue of *Textile Topics* we presented part of a report on a study of the possibility of barré in knitted fabrics resulting from improper settings at rotor spinning. We acknowledged that while barriness has often been caused by variations in fiber properties, blend levels, yarn number and course length, the problem has occurred when none of the above contributed to the imperfection. It was decided, therefore, to determine whether certain mechanical conditions at rotor spinning could lead to barré.

We mentioned last month that the project used West Texas cotton for spinning on a Schlafhorst Autocoro rotor machine. We also listed the variations made at spinning to determine their effect on barré. These involved navel type, navel height, twist multiplier, a combination of twist multiplier and navel type, rotor groove profile and rotor speed.

Three tables of data were presented giving fiber properties of the cotton used, spinning performance and yarn quality for the first three conditions examined in this study. Space did not permit us to give complete results, and we are continuing with the following information taken from the report on this study.

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To assess the ***influence of twist level***, yarns were spun at three twist multipliers, 3.5, 4.0 and 4.5. A four-grooved navel was used for all yarns. Table IV shows the influence of increasing twist on yarn properties. Increased twist produced yarn of improved tensile strength, but the irregularity of the yarn increased. Spinning performance also improved as a consequence of the higher twist.

Groove dimensions are known to alter the characteristics of rotor yarns, particularly physical properties. Yarns were spun with both T and G profiles for comparison. Twist, navel height and type were maintained constant. Table V (page 2) shows that the use of the T-profile rotor produced a yarn of improved tensile properties compared with that spun from a G-profile rotor. Use of the T rotor gave an apparent improvement in spinning stability, although yarn irregularity was almost unchanged.

TABLE IV

INFLUENCE OF TWIST MULTIPLIER

FIBER DATA (Individual Instruments)			
Tensile: Strength (g/tex)	26.14		
Elongation (%)	5.79		
Length: 2.5% Span (in)	1.025		
Uniformity Ratio (%)	47.9		
Short Fiber Content (%)	2.2		
Micronaire	3.82		
Pressley Strength (MPSI)	86.6		
Non-Lint Content (%)	3.85		
SLIVER	56 gr/yd Finisher Drawframe		
Machine	Schlafhorst Autocoro		
Nominal Yarn Number (N_e)	26		
Rotor Type	33G		
Rotor Speed (rpm)	90,000		
Opening Roller Type	OB20		
Opening Roller Speed (rpm)	7500		
Draft	176.5		
Twist Multiplier (α_e)	3.49	4.01	4.49
Yarn Speed (yd/min)	140.4	122.4	109.2
Navel	4G + 1.5 / TT		
Ambient Conditions	70°F/56% RH		
Test Duration (Rotor Hours)	41.8	48	53.7
YARN PROPERTIES			
Skein Test:			
Yarn Number (N_e)	25.73	25.84	25.66
CV% of Count	1.7	1.4	1.6
Count-Strength-Product	1889	2043	2077
CV% of CSP	3.7	3.1	3.7
Single Yarn Tensile Test:			
Tenacity (g/tex)	11.16	12.00	12.31
Mean Strength (g)	256	274	283
CV% of Strength	7.2	8.8	8.4
Elongation (%)	6.03	6.39	6.30
CV% of Elongation	6.5	5.5	6.7
Specific Work of Rupture (g/tex)	0.350	0.389	0.401
CV% of Work of Rupture	12.11	13.57	13.58
Initial Modulus)g/tex)	171	166	186
Uster Evenness Test:			
Non-Uniformity (CV%)	14.20	14.32	14.54
Thin Places/1,000 yds	38	44	39
Thick Places/1,000 yds	36	39	47
Neps/1,000 yds	35	48	58
ASTM Yarn Grade	B+	B	B
PERFORMANCE:			
Number of Breaks	10	10	0
Break Rate/1,000 Rotor hours	239	208	0

As ***rotor speed*** varies, so does the centrifugal force acting upon the yarns during withdrawal from the rotor. Yarn properties are changed and it was anticipated, therefore, that the bulk of the yarn would be a function of the force applied to the yarn. As rotor speeds were increased, the tension draft was reduced in an attempt to maintain an approximately constant take-up tension. Table VI shows the results of increasing rotor speed and simultaneously varying tension draft on yarn properties and winding tension. In general, all yarn properties deteriorated as rotor speed increased.

Table VII (opposite page) gives the details of the fabrics produced. The knitting machine had 32 feeds. The "foreign" yarn was creeled at four feeders, to provide a stripe in the fabric if the character of the yarn differed significantly from that forming the body of the fabric.

Inspection of the greigestate fabric revealed stripes in four fabrics. These were in fabrics numbered 114, 115, 120 and 121. Fabrics 114 and 120 were recorded as having only very slight barré while noticeable barré was recorded in fabrics 115 and 121.

After dyeing, the fabrics were reinspected. Stripes were reported to be noticeable in fabric 114 and very noticeable in fabrics 115 and 121.

Upon reappraising the information, it was apparent that fabric barré arose only when yarn twist varied, but this effect may be enhanced by varying the type of navel. Barré was not apparent in the fabrics knitted from yarns produced from navels of different nature (lots 101 to 110).

A further observation was made. Stripes were lighter than the base material in fabrics 114 and 115. Darker bars were visible in fabrics 120, 121 and123. The reason for this phenomenon lay in the twist multiplier of the yarns. Fabric was apparently darker when produced from yarns of

TABLE V

INFLUENCE OF ROTOR PROFILE

Machine	Schlafhorst Autocoro	
Nominal Yarn Number (N_e)	26	
Rotor Type	33T	33G
Rotor Speed (rpm)	90,000	
Opening Roller Type	OB20	
Opening Roller Speed (rpm)	7500	
Draft	176.5	
Twist Multiplier (a_e)	4.01	
Yarn Speed (yd/min)	122.4	
Navel	4 G + 1.5 mm/TT	
Ambient Conditions	70°F/56% RH	
Test Duration (Rotor Hours)	48	
YARN PROPERTIES		
Skein Test:		
Yarn Number (N_e)	25.84	25.90
CV% of Count	1.4	0.9
Count-Strength-Product	2043	1980
CV% of CSP	3.1	3.4
Single Yarn Tensile Test:		
Tenacity (g/tex)	12.00	11.75
Mean Strength (g)	274	268
CV% of Strength	8.8	8.5
Elongation (%)	6.39	6.04
CV% of Elongation	5.5	6.9
Specific Work of Rupture (g/tex)	0.389	0.371
CV% of Work of Rupture	13.57	14.21
Initial Modulus (g/tex)	166	186
Uster Evenness Test:		
Non-Uniformity (CV%)	14.32	14.32
Thin Places/1,000 yds	44	32
Thick Places/1,000 yds	39	40
Neps/1,000 yds	48	54
ASTM Yarn Grade	B	B
PERFORMANCE:		
Number of Breaks	5	10
Break Rate/1,000 Rotor hours	104	208

TABLE VI

INFLUENCE OF ROTOR SPEED AND WINDING TENSION

Machine	Schlafhorst Autocoro				
Nominal Yarn Number (N_e)	26				
Rotor Type	33G				
Rotor Speed (rpm)	40K	95K	100K	105K	107K
Opening Roller Type	OB20				
Opening Roller Speed (rpm)	7500				
Draft	176.5				
Twist Multiplier (α_e)	4.01				
Yarn Speed (yd/min)	122.4	129.2	136.0	142.8	145.5
Navel	4G + 1.5 mm/TT				
Tension Draft	0.983	0.980	0.976	0.972	0.972
Ambient Conditions	70°F/56% RH				
Test Duration (Rotor Hours)	48.1	45.5	43.3	41.2	40.4
YARN PROPERTIES					
Skein Test:					
Yarn Number (N_e)	25.84	25.52	25.91	25.65	25.81
CV% of Count	1.4	1.3	1.5	1.1	1.2
Count-Strength-Product	2043	1946	1960	1909	1870
CV% of CSP	3.1	4.8	3.2	3.3	2.5
Single Yarn Tensile Test:					
Tenacity (g/tex)	12.00	11.59	11.67	11.41	11.17
Mean Strength (g)	274	268	266	263	256
CV% of Strength	8.8	8.6	7.5	6.0	8.5
Elongation (%)	6.39	6.15	6.01	5.58	5.56
CV% of Elongation	5.5	7.3	6.8	7.1	8.3
Specific Work of Rupture (g/tex)	0.389	0.370	0.361	0.346	0.323
CV% of Work of Rupture	13.57	15.17	13.25	15.00	14.96
Initial Modulus (g/tex)	166	172	174	176	191
Uster Evenness Test:					
Non-Uniformity (CV%)	14.32	14.72	15.07	15.49	15.57
Thin Places/1,000 yds	44	44	57	76	97
Thick Places/1,000 yds	29	55	73	108	96
Neps/1,000 yds	48	68	122	141	196
ASTM Yarn Grade	B	B	B	B	B
Measured Tension (g)	23.3	23.6	17.2	10.8	14.4
PERFORMANCE:					
Number of Breaks/Sample	10	7	6	14	9
Break Rate/1,000 Rotor hours	208	154	139	340	223

higher twist multiplier. Since the basis of fabrics 114 and 115 was of yarn of high twist multiplier (4.49) the stripes were light because yarns of lower twist multiplier (4.01 and 3.49, respectively) were used. In the case of fabrics 120 and 121, yarn spun at low twist multiplier (3.49) formed the basis of the fabric, used with yarns of high twist multiplier (4.01 and 4.49, respectively). Consequently, dark stripes were produced.

TABLE VII

KNIT FABRICS PRODUCED

Fabric	Yarn in Body of Fabric		Yarn in Stripe of Fabric	
Number	Yarn Lot	Parameters	Yarn Lot	Parameters
Influence of Navel Type				
101	4	Smooth	---	---
102	4	Smooth	1	4G
103	4	Smooth	5	8G
104	4	Smooth	6	4G 4R
105	1	4G	---	---
106	1	4G	5	8G
107	1	4G	6	4G 4R
108	5	8G	---	---
109	5	8G	6	4G 4R
110	6	4G 4R	---	---
Influence of Navel Height				
111	10	0 mm	---	---
112	10	0 mm	1	1.5 mm
Influence of Twist and Navel Type				
113	9	4.49/Smooth	---	---
114 *	9	4.49/Smooth	1	4.01/4G
115 **	9	4.49/Smooth	11	3.49/8G
116 (105)	1	4.01/4G	---	---
117	1	4.01/4G	11	3.49/8G
118	11	3.49/8G	---	---
Influence of Twist Multiplier				
119	8	3.49	---	---
120 *	8	3.49	1	4.01
121 **	8	3.49	7	4.49
122 (105)	1	4.01	---	---
123 *	1	4.01	7	4.49
124	7	4.49	---	---
Influence of Rotor Profile				
125	2	T	---	---
126	2	T	1	G
Influence of Rotor Speed and Winding Tension				
127	16	107K	---	---
128	16	107K	15	105K
129	16	107K	14	100K
130	16	107K	12	95K
131	16	107K	1	90K
132	15	105K	---	---
133	15	105K	14	100K
134	15	105K	12	95K
135	15	105K	1	90K
136	14	100K	---	---
137	14	100K	12	95K
138	14	100K	1	90K
139	12	95K	---	---
140	12	95K	1	90K
141 (105)	1	90K	---	---

*Barré Slightly Visible **Barré Clearly Visible

Conclusions coming from this study are:

1. Yarn quality tended to deteriorate when
   a. rougher navels were used;
   b. twist multiplier was reduced;
   c. G-profile rotors were used;
   d. rotor speeds were increased.
2. Fabric appearance was not visibly affected by mixing Ne 26/1 yarns which were produced at different rotor speeds, different rotor profiles or navel height.
3. Stripes were visible in greigestate and dyed knitted fabrics when yarns produced at different twist levels were mixed. The effect may have been augmented by the use of navels of different roughness.
4. Color measurements performed on dyed fabrics, each fabric being composed entirely of a yarn spun at a different specification, provided no explanation for the barré observed in the fabrics knitted from mixed yarns.
5. The barré in the fabric appeared to be caused primarily by a difference in the angle at which the loops lie in the fabric, as a result of differences in twist liveliness in the yarn.

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Space in this bulletin is not sufficient for the reproduction of the full report on this study, which was prepared by John B. Price, assistant director of ICTRD, but the data presented here and in last month's issue of *Topics* give the essential part of the report.

Price was assisted in this research by William D. Cole, manager of spinning technologies, and Richard N. Combs, head of chemical processing. This study was sponsored by the Texas Food and Fibers Commission.

VISITORS

Visitors to the International Center for Textile Research and Development during February included Roger Bolick and Judd Schwartz, Allied Fibers, Hopewell, VA; Kurt Masurat and Danny Gilmore, George A. Goulston Co., Monroe, NC; Rex Dunn, Dunn Seed & Delinting, Seminole, TX; Ron Thorp, Casa Grande, AZ; Carl Cox, Texas Food and Fibers Commission, Dallas, TX; Paul C. Morgan, Excel International, Inc., West Hempstead, NY; Brian May, Mohair Council of America, San Angelo, TX; Jacob Goetz and Dale Pepper, Goetz & Sons, Inc., Dallas, TX; Howard Baker, Joe Waddell and Jack Crooks, Milliken Company, Spartanburg, SC; Takamasa Miyauchi, Texas Department of Commerce, Austin, TX; Jozef Uhrín, Slovakotex Inc., Trencin, Czechoslovakia; and Bretislav Musil, Zavody MDZ, Bratislava, Czechoslovakia.

Also touring the Center were Jerry Hinnenkamp and 12 other members of the Brownfield Board of Industrial Development, Brownfield, TX.; and 45 Agricultural Economics students from Texas Tech University's College of Agricultural Sciences.