TRC

# TEXTILE TOPICS

TEXTILE RESEARCH CENTER • TEXAS TECH UNIVERSITY • LUBBOCK, TEXAS • USA

Volume XIV, No. 6
February 1986

**SPINNING FINE OPEN-END YARNS: PART IV** We intend for this to be the concluding report of research involving the spinning of fine yarns on open-end machinery. We have presented in earlier issues of *Textile Topics* the results of spinning $N_e$ 40, 50 and 60 yarn numbers. Therefore, the information given on the following pages is a summary of our findings.

For our readers' convenience, we are presenting once again the properties of the cotton used in this study. See Table I. In Table II we have grouped the three numbers for both the carding and combing processes to facilitate an evaluation of what happens to spinning performance and yarn quality as yarns become finer. It will be seen that all spinning was done with the same machine and conditions. By necessity, the draft had to change in order to give the desired yarn numbers. Also, the test duration in rotor hours varied from yarn to yarn, and there was a minor difference in the twist multiplier for the $N_e$ 40 yarn. However, this was so slight that we do not feel it introduced a variable of significant value.

Figures 1, 2 and 3 show trends in yarn strength and uniformity as the finer numbers were spun. In general, these measurements are what might be expected. The strength decreased with the finer yarns and the combed yarns were stronger than the carded, although they had somewhat greater non-uniformity. Processing details have been given in earlier reports and will not be repeated here.

We would like to state once more that this work was sponsored by the Natural Fibers and Food Protein Commission of Texas. It was conducted at the Textile Research Center under the supervision of John Price who was assisted by a number of technicians.

**VISITING SCIENTISTS** We are pleased to have three international scientists visiting with us at this time. They all joined the activities of the Textile Research Center in September 1985 and plan to be with us for approximately one year. Their research is in various areas of textile fibers and fabrics, as we are indicating in the following summaries of their backgrounds and interests.

*Dr. Slobodana Matic* is an assistant professor in the Department of Textile Engineering, School of Technology and Metallurgy, University of Beograd, Beograd, Yugoslavia. She has come to Texas Tech University on a specialization fellowship funded by the International Research & Exchange Board of New York. Her research field is in textile testing and quality control, specializing in knitted structures.

Dr. Matic received a bachelor's degree in textile engineering from the University of Beograd in 1967 and worked in the Yugoslav textile industry for three years. In 1970 she returned to the university for graduate studies and earned a master's degree in 1975 and her doctorate in 1981. Her doctoral dissertation was entitled, "The Study of Modeling Wool Plain Weft Knitted Fabrics Based on Some Characteristic Parameters of the Structure."

At TRC, Dr. Matic is working with testing and quality control methods for knitted fabrics and studying computer techniques for the determination of fabric properties. She is developing a mathematical model with the optimized properties of knitted fabrics which will be formed using advanced statistics, the analysis of variance, regression analysis with multiple linear regression, and polynomial regression.

Her ten-year old son, Milan, is in the United States with her and is enrolled in the 4th grade at a Lubbock elementary school.

*Dr. Radoslav Aleksic* came to Texas Tech as a post-doctoral research fellow from the University of Beograd, Beograd, Yugoslavia, where he serves as an assistant professor in the Department of Materials Science, School of Technology and Metallurgy. He received a bachelor's degree in chemical engineering in 1976, a master's degree in 1980, and his doctorate in 1985. All are from the university of Beograd. His doc-

TABLE I

Fiber Properties

| | |
|---|---|
| Strength (g/tex) | 31.1 |
| Elongation (%) | 5.92 |
| 2.5% Span Length (in) | 1.278 |
| Uniformity Ratio (%) | 42.8 |
| Short Fiber Content (%) | 8.0 |
| Micronaire | 4.08 |
| Non-Lint Content (%) | 2.0 |

TABLE II

Machine Specifications and Yarn Testing Results

| Sliver | 40 gr/yd 2nd Passage Drawframe After Carding | | | 40 gr/yd 2nd Passage Drawframe After Combing* | | |
|---|---|---|---|---|---|---|
| Machine | Schlafhorst Autocoro | | | | | |
| Nominal Yarn Number ($N_e$) | 40/1 | 50/1 | 60/1 | 40/1 | 50/1 | 60/1 |
| Rotor Type | G40 | | | | | |
| Rotor Speed (rpm) | 72,000 | | | | | |
| Opening Roller Type | OB20 | | | | | |
| Opening Roller Speed (rpm) | 7000 | | | | | |
| Draft | 191 | 239 | 273 | 184 | 228 | 273 |
| Twist Multiplier ($\alpha_e$) | 4.47 | 4.50 | 4.50 | 4.47 | 4.50 | 4.50 |
| Yarn Speed (yd/min) | 70.7 | 63.0 | 57.4 | 70.7 | 63.0 | 57.4 |
| Navel | KK4 | | | | | |
| Ambient Conditions | 72°F/56% RH | | | | | |
| Test Duration (Rotor hours) | 32.5 | 36.5 | 5.7 | 32.5 | 36.5 | 40.0 |
| YARN PROPERTIES | | | | | | |
| Skein Test: | | | | | | |
| Yarn Number ($N_e$) | 39.54 | 49.25 | 56.72 | 39.37 | 49.00 | 58.84 |
| CV% of Yarn Number | 0.6 | 1.9 | 1.3 | 0.9 | 1.6 | 2.0 |
| Count-Strength-Product | 2101 | 1858 | 1699 | 2191 | 1959 | 1800 |
| CV% of CSP | 2.9 | 2.7 | 3.3 | 3.0 | 5.2 | 4.6 |
| Single Yarn Tensile Test: | | | | | | |
| Tenacity (g/tex) | 14.11 | 14.13 | 13.40 | 15.82 | 15.44 | 14.85 |
| Mean Strength (g) | 211 | 169 | 140 | 237 | 186 | 149 |
| CV% of Strength | 8.6 | 9.2 | 11.7 | 8.4 | 10.6 | 11.7 |
| Elongation (%) | 5.35 | 5.25 | 4.69 | 5.44 | 5.59 | 5.17 |
| CV% of Elongation | 8.2 | 8.8 | 13.1 | 8.1 | 9.4 | 12.0 |
| Specific Work of Rupture (g/tex) | 0.385 | 0.375 | 0.331 | 0.431 | 0.423 | 0.377 |
| CV% of Work of Rupture | 14.7 | 16.0 | 21.7 | 14.9 | 17.6 | 21.1 |
| Initial Modulus (g/tex) | 368 | 371 | 436 | 373 | 392 | 424 |
| Uster Evenness Test: | | | | | | |
| Non-Uniformity (CV%) | 17.32 | 19.00 | 19.93 | 17.50 | 19.07 | 20.47 |
| Thin Places/1,000 yds | 151 | 374 | 573 | 166 | 390 | 706 |
| Thick Places/1,000 yds | 331 | 528 | 674 | 358 | 556 | 746 |
| Neps/1,000 yds | 1060 | 1526 | 2036 | 808 | 1274 | 1669 |
| Hairs/100 yds | 210 | 148 | 125 | 315 | 205 | 194 |
| Performance: | | | | | | |
| Number of Breaks | 8 | 21 | 6 | 2 | 8 | 55 |
| Break Rate/1,000 Rotor hours | 246 | 576 | 1050 | 61.6 | 219 | 1375 |

* Noils Removed in Combing = 15.3%

FIGURE 1: COUNT–STRENGTH–PRODUCT

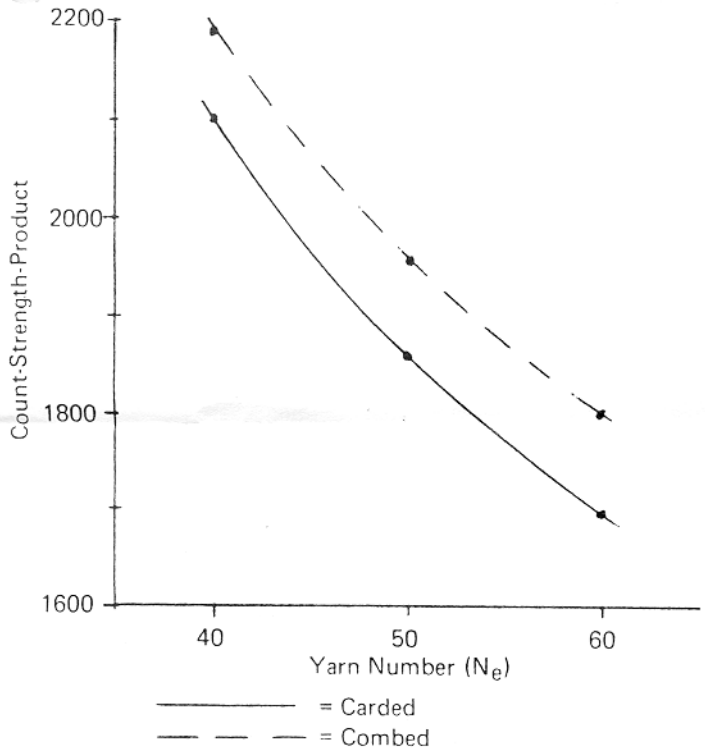



FIGURE 2: TENACITY (g/tex)

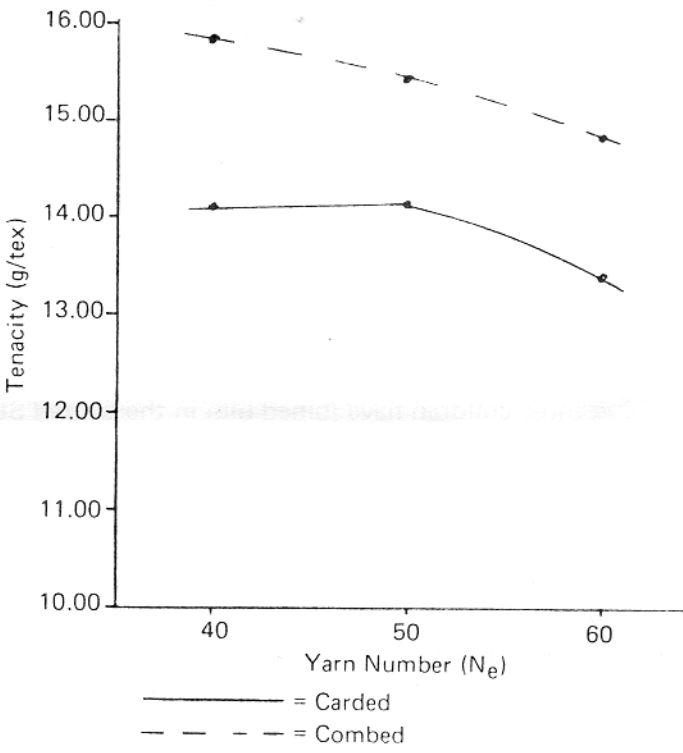
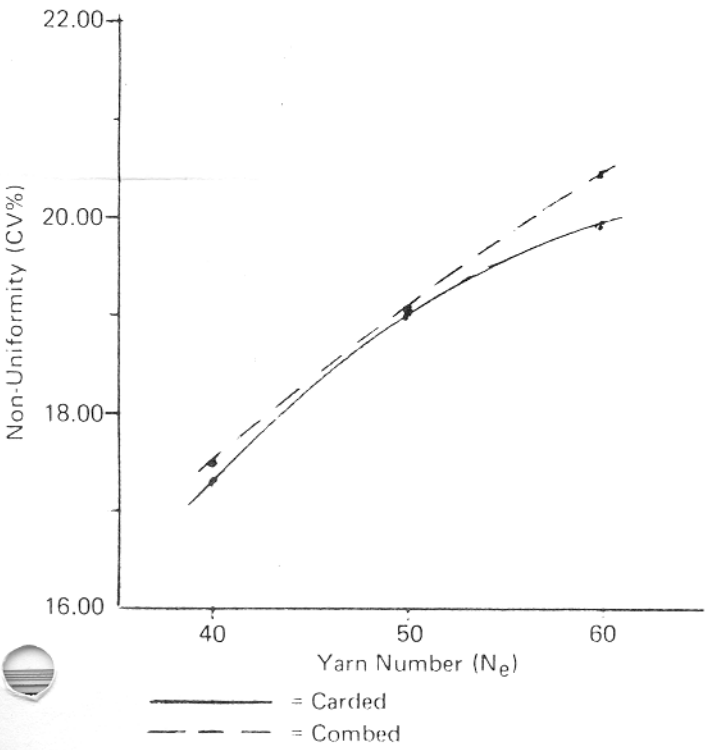



FIGURE 3: NON–UNIFORMITY (CV%)




toral dissertation was "Modeling and Computer Simulation of the Drawing Process for the Optical Fibres." His primary research field is kinetics of solid state reaction and viscous deformation in noncrystalline materials, and he has conducted several projects dealing with optical fiber technology.

Since coming to TRC, Dr. Aleksic has been studying computer analysis kinetic parameters from thermogravimetrical (TG) curves for textile materials. He has made TG analyses for different textile blends in both nitrogen and air atmospheres. For blends with different compositions, he has determined onset decomposition temperature, temperature of transformation, and decomposition completed temperature and relative percent of mass residual. He is working with TRC's Dr. R. D. Mehta in making TG analyses for different kinds of washed, unwashed and bleached cotton fabrics. Their goal is to develop an objective method for differentiation of washed, unwashed and bleached fabrics by thermal analysis and to develop a computer determination of the kinetic

parameters for the washing and bleaching process of textile materials.

*Dr. Joseph Perel* came to the Textile Research Center on sabbatical leave from the Israeli Fiber Institute in Jerusalem. He is conducting a research project entitled, " An X-Ray Study on Development of Structural Characteristics in Growing Cotton Fibers: Their Relevance to Maturity." This is designed to investigate the feasibility of introducing the crystallographic quantities of cotton for characterization of fiber quality. It deals with evaluating the dependence of the dimension of the cellulose crystallites on duration of their growth. The main objective is to determine the degree of precision of this measurement and adequacy of its application in practical problems involved with maturity determination. It is believed that this research can also be of value in a study of such problems as the non-uniformity of maturity along the fiber's length and the development of bundles of dead fibers in a cotton boll.

Dr. Perel received his master's degree in physics from Hebrew University, Jerusalem, in 1960 and a doctorate in physics from the same university in 1966. He has served as a research associate in physics at Cornell University, Ithaca, New York, and as research physicist for the National Bureau of Standards, Washington, DC. In Israel, he was lecturer in the Physics Department at The Technicon in Haifa, and has been Senior Research Physicist and X-ray specialist with the Israeli Fiber Institute since 1971. His wife and three children have joined him in the United States.

**VISITORS** Representatives of the Philippine Textile Research Institute, Manila, visited the Center on January 13-15 to explore the possibility of establishing a cooperative research program between their organization and ours. Terecita C. Nonato and Leonora C. Valdez studied research programs underway here and explored support resources available on the Texas Tech campus.

Other visitors during January included Steve Clarke, Gentex Corporation, Carbondale, PA; Grant Crawford, Seabrook, Anderson, SC; Greg Curran, Perkin Elmer Corp., Richardson, TX; Dean Pelzar, Cotton Incorporated, Raleigh, NC; Roger Bolick, Allied Plastics & Fibers, Hopwell, VA; Doug Fain, Danville, VA; Tom R. Wallace, Anacacho Petroleum, Inc., San Antonio, TX; Thomas Vernon, Burckhardt America, Inc., Greensboro, NC; and Cynthia L. Kradjel, Technicon Instruments Corp., Tarrytown, NY.