EXPERIMENTAL CHARACTERIZATION OF THE STRENGTH OF KEVLAR KM2 YARNS UNDER QUASI-STATIC TESTING

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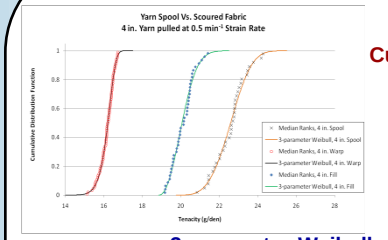
OBJECTIVES

- To characterize the tenacity of 600 denier Kevlar KM2 yarns
- To characterize the effects of gage length on the tenacity
- To characterize the effect on tenacity resulting from damages induced by weaving on the warp and fill yarn separately
- Begin to establish an extensive material database for input into the FE simulation of the impact of woven fabrics

YARN SPOOL VS. SCOURED FABRIC: 4 IN.



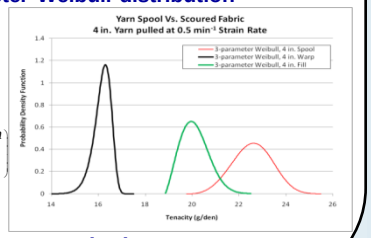
Cumulative Distribution Function (CDF)

$$F(\sigma) = 1 - \exp\left(-\left(\frac{(\sigma - x)}{\sigma_0}\right)^m\right)$$

3-parameter Weibull distribution

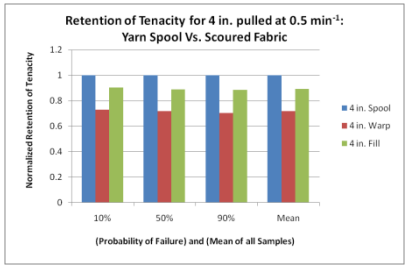
Probability Density Function (PDF)

$$f(\sigma) = \left(\frac{m}{\sigma_0}\right)\left(\frac{(\sigma - x)}{\sigma_0}\right)^{m-1} \exp\left(-\left(\frac{(\sigma - x)}{\sigma_0}\right)^m\right)$$



σ_0 is the scale parameter, m is the shape parameter
x is the threshold parameter

YARN SPOOL VS. SCOURED FABRIC: 4 IN. CONTINUED…



Probability of Failure					
Tenacity	**10%**	**50%**	**90%**	**Mean**	**Mean Prob (%)**
4 in. Spool	21.46	22.59	23.67	22.57	49.32
4 in. Warp	15.66	16.21	16.59	16.16	44.00
4 in. Fill	19.37	20.06	20.91	20.10	52.46
Normalized W.R.T Yarn Spool					
Retention	**10%**	**50%**	**90%**	**Mean**	
4 in. Spool	1.00	1.00	1.00	1.00	
4 in. Warp	0.73	0.72	0.70	0.72	
4 in. Fill	0.90	0.89	0.88	0.89	

End-Tabbing (Sample Preparation)

- Center a sample on one end tab
- Use two staples to secure sample to the tab
- Use a paper clamp to fix the end of the sample with the attached end tab to a ruler
- Attach a second end tab to the other end of the sample and adjust to the desired gage length using the ruler
- Use two staples to secure the second end tab to the sample

End-Tabbing (Epoxy Treatment)

- Using a glue gun, apply a drop of epoxy on top of the sample and end tab at both ends of the sample
- Place another end tab on top of the epoxy making a sandwich
- Using a stapler apply two staples to hold the second end tab in place
- Repeat the process at the other end of the sample

End-Tabbing (Data Collection)

- Using Instron 5567 and 5000 N grips place a sample within the grips and close the top grip
- Allow self alignment within the bottom grip and then close
- Apply about 5 N for a few seconds to the sample to straighten microfibers
- Reduce the load to about 0.1 N for sample testing and collect data: maximum modulus, peak load and the strain at peak load of sample

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