Testing Aramid Cords
The Proper Grip – ASTM D 7269
Application Note

Introduction

Aramid cords are synthetically prepared and are stronger per weight than steel. Due to this high strength nature, finding the correct grips for use in a tensile test can be quite challenging. Besides slipping within the grip, cords can also exhibit internal slippage in the jaw, where one fiber is slipping past the others. This kind is much harder to detect and can lead to jaw breaks and/or inaccurate results.

This application study tests an aramid cord using Instron®'s standard pneumtaic cord and yarn grips and compares the results to those obtained with Instron's unique pneumatic aramid cord and yard grips to determine which is more accurate and suitable.

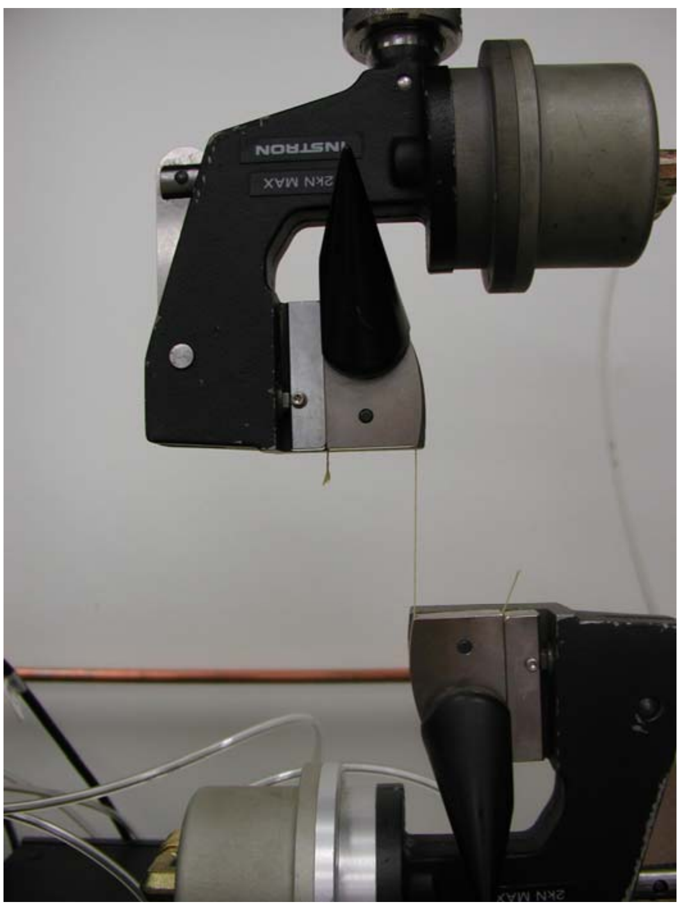

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Figure 2:
Detailed specimen loading.

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Figure 1:
The test configuration, setup on the 5569 dual column testing frame with the 2 kN pneumatic aramid cord and yarn grips, Bluehill® 2 Software and 5 kN static load cell.

Test Configuration and Sample Preparation

A 5569 Instron dual column testing frame was fitted with a 5 kN Instron static load cell, and the 1.75 kN Instron pneumatic cord and yarn grips. The gauge length of the specimen was set to 250 mm. The test was conducted at a crosshead speed of 250 mm/min, per ASTM D 7269, and data was acquired at an interval of 50 ms into Bluehill 2 Software. To check for slippage, flags of tape were attached to the ends of the cord and monitored to make sure there was no relative movement of the flag with respect to the grip. The 1.75 kN cord and yarn grips were then replaced with Instron's 2 kN pneumatic aramid cord and yarn grips for the second test.

Results and Analysis

As seen by Figures 3 and 4, the aramid cord and yarn grips produced results with a much higher correlation than the regular cord and yarn grips. Looking at the statistics of Tables 1 and 2, we notice two distinct patterns.

First, the standard deviation of the data obtained with the regular cord and yarn grips is almost three times that which was obtained with the aramid cord and yarn grips, proving our first observation about the differences in the graphs.

Second, the mean max load obtained using the regular cord and yarn grips is about 6% lower than the one obtained using the aramid cord and yarn grips. This, combined with the fact that three jaw-breaks occurred, shows that the material was weakened by the cord and yarn grips in a manner that prevents accurate material testing.

The data obtained with the aramid cord and yarn grips did not exhibit this kind of weakening.

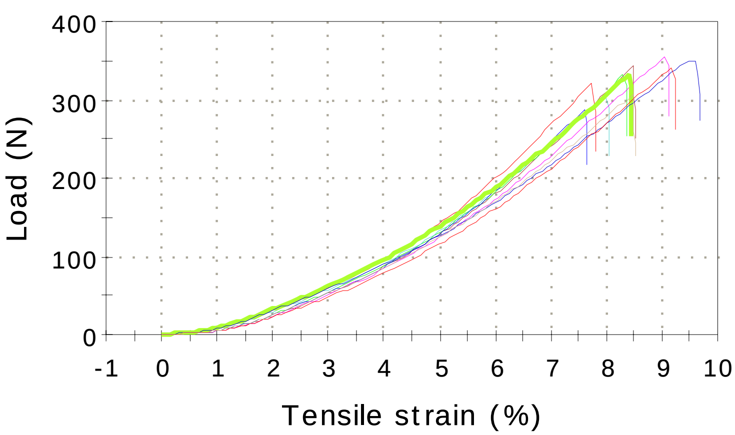

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Figure 3:
The load versus tensile strain graph for testing with the 1.75 kN cord and yarn grips.

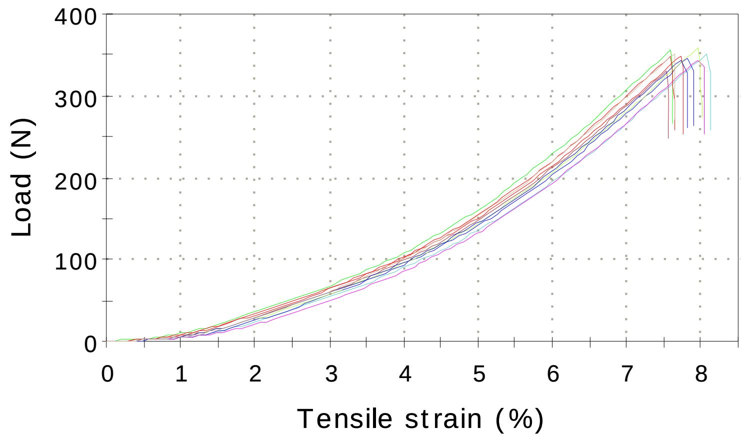

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Figure 4:
The load versus tensile strain graph for testing with the 2 kN aramid cord and yarn grips.

Conclusions and Recommendations

Looking at the differences in the results between the regular and aramid cord and yarn grips, it seems that the cords gripped with the regular grips exhibited internal slippage in the jaw. This means that the fibers within the jaw slipped past one another, which jeopardizes the accuracy of the test results.

When internal slippage occurs, the cord is weakened for obvious reasons. In order to correct for this, higher air pressure can be used, but this could lead to jaw breaks, further jeopardizing the accuracy of the test results.

The aramid cord and yarn grips did not exhibit symptoms of internal slippage. Due to the unique surface finish of the jaws, they are able to grip the strong aramid cord in such a manner that limits internal slippage and provides more accurate and consistent results.

It is recommended that whenever aramid fibers are being tested, Instron®'s pneumatic aramid cord and yarn grips are always used to provide the most accurate test results.

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Specimen #	Max Load (N)	Break Location	Extension (mm)
1	321.61	Gauge Length	19.76
2	342.74	Gauge Length	21.49
3	331.23	Gauge Length	22.08
4	306.76	Gauge Length	20.82
5	286.57	Jaw	20.34
6	354.32	Gauge Length	24.09
7	333.46	Gauge Length	21.04
8	350.07	Gauge Length	23.78
9	341.75	Jaw	23.02
10	306.44	Jaw	21.95
Mean	327.49		21.84
S.D.	21.85		1.44

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Table 1:
Data table for specimens tested with regular 1.75 kN cord and yarn grips.

Specimen #	Max Load (N)	Break Location	Extension (mm)
1	349.18	Gauge Length	19.48
2	329.86	Gauge Length	20.73
3	354.89	Gauge Length	18.96
4	350.77	Gauge Length	20.61
5	346.54	Gauge Length	19.64
6	344.42	Gauge Length	21.41
7	358.35	Gauge Length	21.07
8	344.44	Gauge Length	20.02
9	348.57	Gauge Length	19.01
10	351.55	Gauge Length	19.90
Mean	347.86		20.08
S.D.	7.70		0.85

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Table 2:
Data table for specimens tested with the 2kN aramid cord and yarn grips. Results show a higher peak load and lower standard deviation than the standard cord and yarn grip's results.

Configuration Table

Catalog Number	Configuration Options	Description
5569	Frame	Dual Column Testing Frame
2525-805	Load Cell	5 kN static load cell
2410-400	Software	Bluehill® 2
2714-006	Grip	1.75 kN Cord and Yarn Grip
2714-032	Grip	2 kN Aramid Cord and Yarn Grip

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