The Influence of Sample Preparation on Tensile Test Results

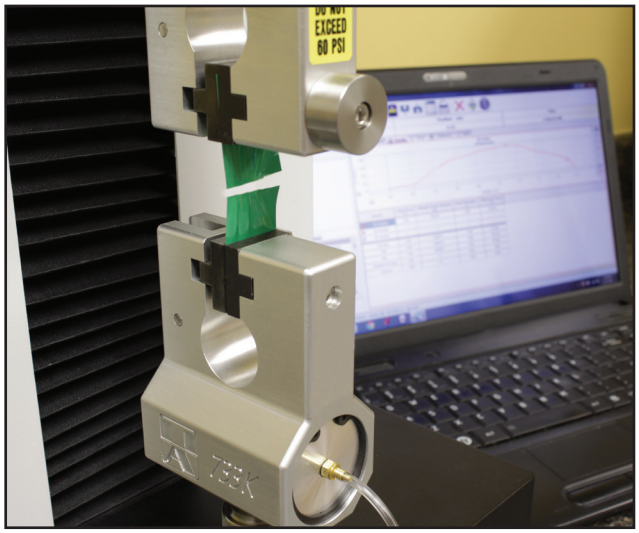
Cuts made to prepare a sample for tensile testing are critical to the accuracy and quality of the results. Preparing a sample without jagged edges or nicks is vital to ensure accurate tensile results. Those imperfections will affect the ability to provide consistent tensile results for the physical properties of the specimen. The way a sample is handled can also have an impact on the tensile test results and should also be handled with care once cut.

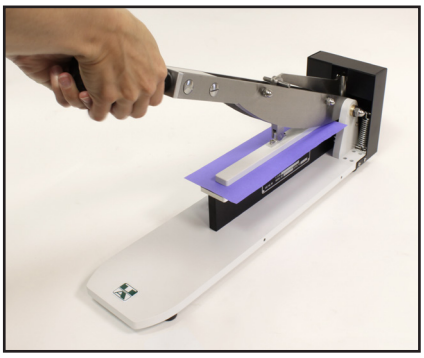
Let's look at the importance of sample preparation using an example testing ASTM D882 for Tensile Properties of Thin Plastic Sheeting. This test method covers the determination of tensile properties of plastics in the form of thin sheeting, including film (less than 1.0 mm (1,000 microns) in thickness). Specimens are placed in the grips of the universal tester and pulled until failure. For ASTM D882, the test speed and grip separation are based on the elongation to break the material. Elongation and tensile modulus can be calculated from crosshead displacement.

Specimen Size:
Uniform width, thickness, and 2 inches longer than the gage-length

Sample Width :
It shall not be less than 5mm , or greater than 25.4mm (selection of common width: 15mm or 25mm or 25.4mm)

The utmost care shall be exercised in cutting specimens to prevent nicks and tears which are likely to cause premature failures. The edges shall be parallel to within 5% of the width over the length of the specimen between the grips. Microscopical examination of specimens may be used to detect flaws due to sample or specimen preparation.

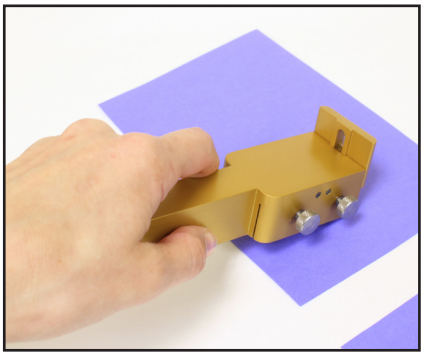




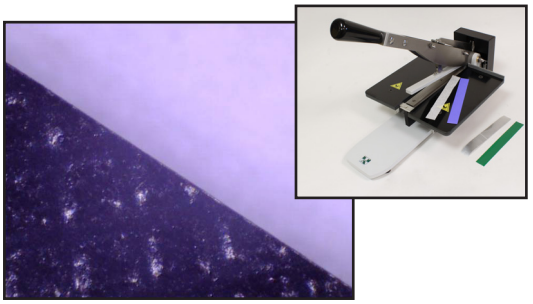
JDC Precision Sample Cutter

VS

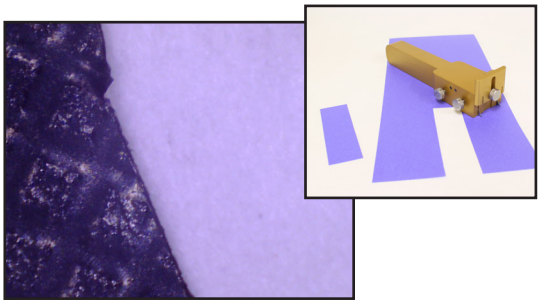
MTT 1" Strip Cutter



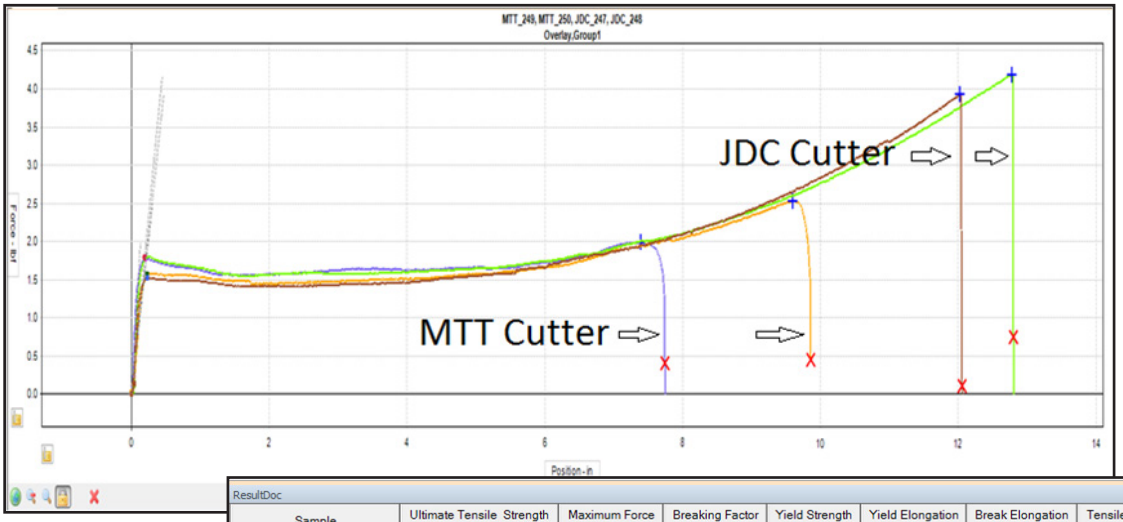
For the purpose of demonstrating the importance of the sample cut, two preparation tools were evaluated - the JDC Precision Sample Cutter and the MTT 1” Strip Cutter. Using a black plastic film, images shown are a 200 time magnification of the cuts made:



JDC Precision Sample Cutter



MTT 1” Strip Cutter



ResultDoc

Sample	Ultimate Tensile Strength psi	Maximum Force lbf	Breaking Factor lbf/in	Yield Strength psi	Yield Elongation %	Break Elongation %	Tensile Energy AT Break ft*lbf/ft ²	Elastic Modulus ksi
Sample Preparation: MTT								
MTT_250	5049	2.52	10.10	3156	11.41	493.0	405655	32.49
MTT_249	3965	1.98	7.93	3554	10.05	387.4	309910	59.18
Average	4507	2.25	9.01	3355	10.73	440.2	357782	45.84
Max	5049	2.52	10.10	3554	11.41	493.0	405655	59.18
Min	3965	1.98	7.93	3156	10.05	387.4	309910	32.49
Standard Deviation	766	0.38	1.53	281	0.97	74.7	67702	18.87
Variance	587504	0.15	2.35	79169	0.93	5577.0	4583566722	356.19
Sample Preparation: JDC								
JDC_248	7849	3.92	15.70	3046	11.42	602.7	581445	33.75
JDC_247	8356	4.18	16.71	3595	9.48	640.1	668303	37.18
Average	8102	4.05	16.20	3321	10.45	621.4	624874	35.46
Max	8356	4.18	16.71	3595	11.42	640.1	668303	37.18
Min	7849	3.92	15.70	3046	9.48	602.7	581445	33.75
Standard Deviation	359	0.18	0.72	388	1.37	26.4	61418	2.43
Variance	128873	0.03	0.52	150618	1.89	697.7	3772205385	5.89
Average	6305	3.15	12.61	3338	10.59	530.8	491328	40.65
Max	8356	4.18	16.71	3595	11.42	640.1	668303	59.18
Min	3965	1.98	7.93	3046	9.48	387.4	309910	32.49
Standard Deviation	2132	1.07	4.26	277	0.98	114.2	162987	12.51
Variance	4546720	1.14	18.19	76988	0.97	13038.1	26564626807	156.59

The results clearly show the quality of cut make a large difference in the results!