



MICHIGAN STATE UNIVERSITY
LAP SHEAR TEST



LINKTECH INC. LAMINATED MATERIALS

4 - POINT FLEX TESTING

Test Date: 1/16/2014

Operator: Brian Rook

Michigan State University
Composite Materials and Structures Center

ID: Composite Advantage

Sample #	Modulus	Strength	Width	Thickness	Peak Load	Flexural Yield Strength	Flexural Modulus	Comments
	Test #	Test #	in	in	lbf	psi	psi	
C1	1199	N/A	0.994	0.528	316.5	N/A	449,376	See Note 1 below. Not included in statistics
C2	1201	1217	0.996	0.533	351.2	7,465	421,091	
C3	1202	1218	0.994	0.526	358.8	7,828	449,314	
C4	1203	1219	0.972	0.529	374.5	8,282	461,631	
C5	1204	1220	0.990	0.532	388.4	8,317	440,726	
C6	1205	1221	0.989	0.552	375.1	7,482	398,272	
Mean			0.988	0.534	369.6	7,875	434,207	
Std Dev			0.010	0.010	14.7	414	24,931	
COV			0.010	0.019	0.040	0.053	0.057	

ID: Aptec

Sample #	Modulus	Strength	Width	Thickness	Peak Load	Flexural Yield Strength	Flexural Modulus	Comments
	Test #	Test #	in	in	lbf	psi	psi	
A1	1206	1222	0.964	0.479	543.9	14,756	1,079,613	
A2	1207	1223	0.966	0.495	560.8	14,257	981,641	
A3	1208	1224	0.952	0.480	552.8	15,162	1,057,108	
A4	1209	1225	0.964	0.477	560.9	15,344	1,051,324	
A5	1210	1226	0.964	0.476	547.8	15,055	1,091,876	
Mean			0.962	0.481	553.2	14,915	1,052,312	
Std Dev			0.006	0.008	7.6	425	42,805	
COV			0.006	0.016	0.014	0.029	0.041	

ID: Plexus

Sample #	Modulus	Strength	Width	Thickness	Peak Load	Flexural Yield Strength	Flexural Modulus	Comments
	Test #	Test #	in	in	lbf	psi	psi	
P1	1211	1227	0.967	0.484	539.1	14,279	1,045,772	
P2	1212	1228	0.955	0.504	590.9	14,614	1,037,014	
P3	1213	1229	0.968	0.489	541.7	14,438	1,013,392	
P4	1214	1230	0.967	0.487	572.6	14,988	1,056,308	
P5	1215	1231	0.965	0.485	541.7	14,318	1,052,040	
Mean			0.964	0.490	557.2	14,527	1,040,905	
Std Dev			0.005	0.008	23.4	289	17,008	
COV			0.005	0.017	0.042	0.020	0.016	

Method: ASTM D6272 Procedure A

Load frame: United Testing Systems SFM-20

Crosshead speed: 0.21 in/min

Load cell capacity

Strength tests: 1000 lb

Modulus tests: 100 lb

16:1 Support Span : Depth ratio

Loading span: 4.0 inch

Support span: 8.0 inch

Notes:

- 1) Test #1199 was terminated at 0.9 inches deflection to protect deflectometer from damage.
- 2) Deflection exceeded deflectometer range of 1 inch, so specimens were tested as follows:
- 3) Specimens were loaded to 0.05 inch deflection for modulus measurements, then unloaded.
This range is within the quasi-linear elastic region of the stress/deflection curve.
Method calls for termination of testing at 5% strain in the outer fibers if failure does not occur.
- 4) Subsequently the loading pin was removed from the deflectometer.
- 5) Method calls for termination of testing at 5% strain in the outer fibers if failure does not occur.
The corresponding deflection (D) was calculated to be nominally 1.5 inch per ¶10.1.7, Formula 4.
- 6) Test #1199 exhibited a nominal crosshead displacement (Z) : deflection (D) ratio Z/D ≈ 0.8.
- 7) All specimens were loaded to nominal 1.2 inches crosshead displacement (Z), which corresponds to a nominal deflection (D) of 1.5 inches based on the Z/D ratio. No failures occurred.
- 8) Modulus evaluation range: 0.00 < D < 0.03 inch.
- 9) Specimens were tested as received at ambient room conditions 76F, 18% RH
- 10) Specimens were placed on fixture with thick black UHMWPE layer facing up.