The Effect of Cure Time on Carbon Fiber Pre-Preg

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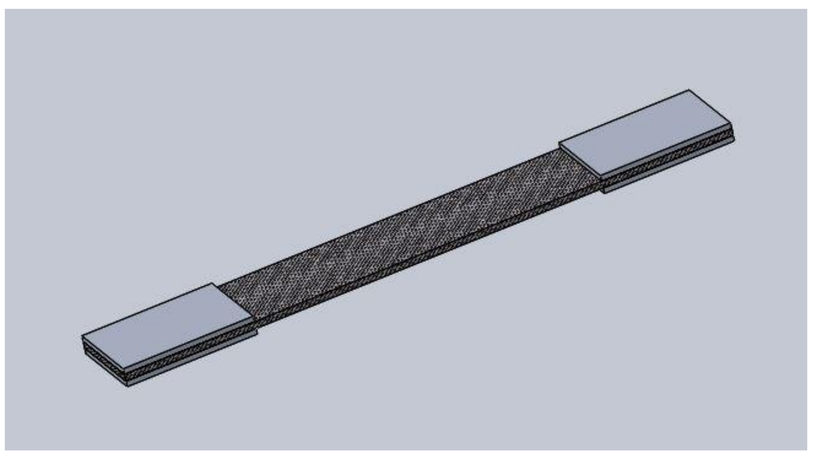
Kellogg Honors College Capstone Project

Objective

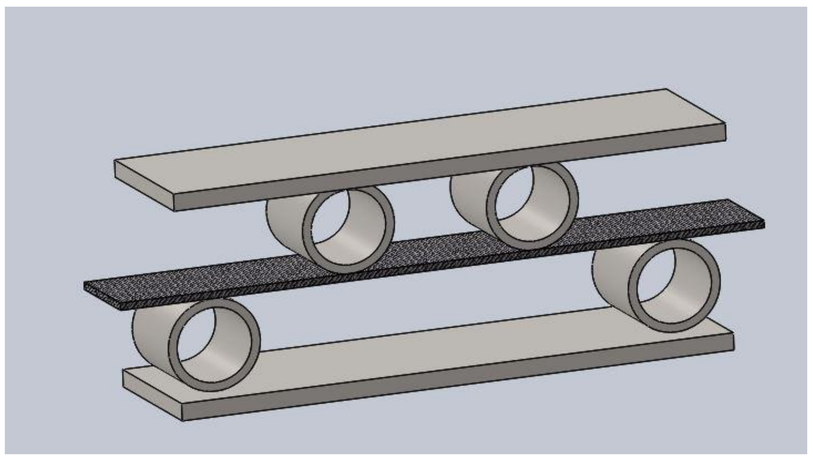
- Understand the effect of curing time on Carbon Fiber pre-preg
- Evaluate sensitivity of material to curing time
- Determine mechanical properties of the material used

Experimental Setup

- 3 samples were created that were cured for 100,130, and 160 minutes
- Each sample used 10 layers of material oriented at 0 degrees
- 3 pieces sized 7in x 1in x 0.080in were created from each sample
- Initially a tension test was to be used for the material testing
  - The tension test sample slipped in the jaws of the machine so actuate deflection data could not be obtained
- A four point bending test was used instead
  - Four point bending testing is not sensitive to slipping
  - Creates constant moment section where the material will fail
- Testing performed on Bluehill tension test machine in strengths lab at Cal Poly Pomona



Tension test sample

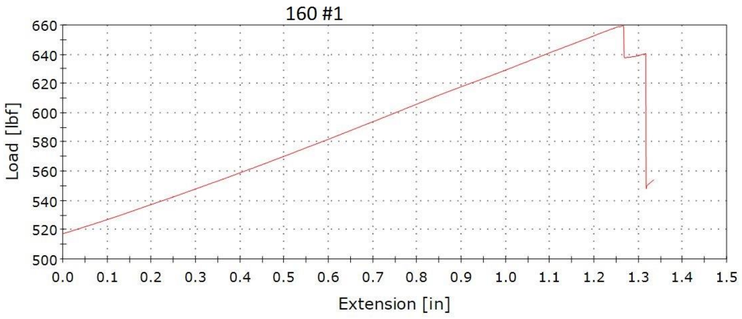


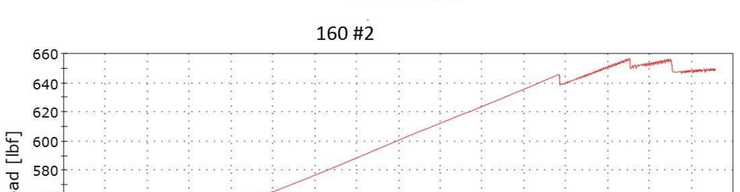
Four Point Bending Test rig

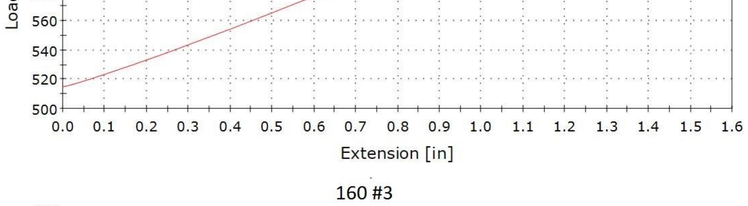
Experimental Conditions

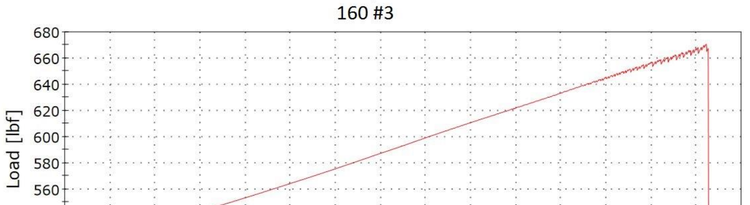
Constants	
Material	Toray T800H
Width	1in
Length	7in
Thickness	0.08in
Variable	
Cure time	100,130,160min

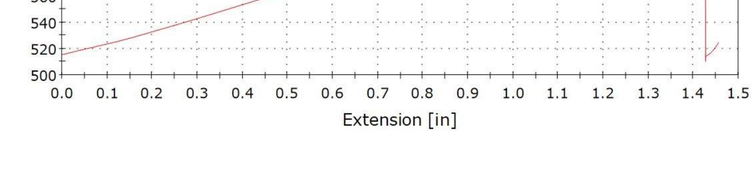
Data











Test rig image

Results Data Table

Sample	width (in)	Thickness (in)	Force(lb)	Displacement (in)
100 #1	0.995	0.08	166.94	0.589
130 #2	0.99	0.08	164.95	0.601
130 #3	0.996	0.08	147.02	0.66
160 #1	0.974	0.08	142.35	0.56
160 #2	0.985	0.08	144.88	0.667
160 #3	0.982	0.08	153.67	0.578

Manufacturer Properties

Toray T800H mechanical properties	
E1 (psi)	10000000
E2 (psi)	10000000
NU 12	0.28
G12 (psi)	730000
Xt (psi)	160000
Yt (psi)	160000
Xc (psi)	93000
Yc (psi)	93000
S (psi)	13000
Strain	1.38

Tested Properties

Toray T800H mechanical properties	
E1 (psi)	12000000
E2 (psi)	12000000
NU 12	0.28
G12 (psi)	730000
Xt (psi)	130000
Yt (psi)	130000
Xc (psi)	93000
Yc (psi)	93000
S (psi)	13000
Strain	1.38

Discussion

- Varying the curing time does not correlate with variations in the ultimate tensile strength
- The observed stiffness of the material is higher that the manufacturer claimed properties.
- The ultimate tensile strength is lower that the manufacturer's specifications
- The variation in strength appears to be related to flaws in the lay up itself
- This could be due to dirt and other debris, air pockets, or old resin
- FEA was used to determine the experimental material properties.