



Laminar Shear Strength Comparison between Laminates Made Using a Carbon Fabric Control and a Carbon Fabric with Layers of Carrier Scrim.

Historically speaking, those versed in the art of laminate composites would suggest that the addition of either a light-weight polyester reinforcement or any reinforcement coated with an organic binder would be incompatible with standard resin systems and would act as a contaminant to the overall properties of the laminate by making the laminate weaker. To test this hypothesis, two versions of carbon laminates were made using the resin infusion process in order to determine whether the addition of a light-weight, polyester carrier scrim coated with latex binder would be a contaminant or not to the laminar shear strength in a short beam shear test.

The “carbon fabric only” control laminate was made using 20 plies of 300 gsm carbon fabric hand laid up in a 0°, 90° configuration, while the carbon/carrier scrim laminate was made in the same way, except a carrier scrim layer was added after every 0°, 90° carbon layer to create a 0°, 90°, carrier scrim x 20 plies configuration. An epoxy resin system was used with a 70 minute gel time and a viscosity of 220 cps. Both samples were infused at 77°F under 29.5” Hg vacuum.

Each laminate was tested by a third-party lab in accordance with ASTM D2344, “Standard Test Method for Short Beam Shear of Polymer Matrix Composite Materials and their Laminates”.

Test Equipment Used:

Instron 1350 RP Universal Testing Machine with Admet MTEST Quatro Digital Electronics, S/N 1885, Cal Due - July 2013

Instron Load Cell, S/N 3352, Cal Due - July 2013

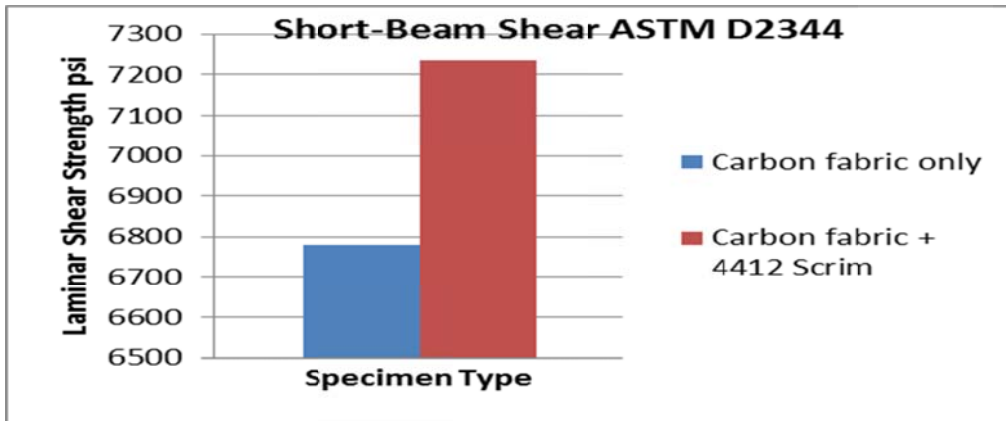
Mitutoyo Digital Calipers, S/N 08090384, Cal Due - Feb 20

Laminar shear strength was measured and test results are shown below:

Carbon Fabric Only	Max. load (lbf)	Width (in)	Thickness (in)	Laminar Shear Strength (psi)
Specimen 1	1625	0.6270	0.3100	6270
Specimen 2	1821	0.6390	0.3295	6488
Specimen 3	1903	0.6240	0.3045	7511
Specimen 4	1781	0.6305	0.3160	6703
Specimen 5	1973	0.6375	0.3350	6929
Avg	1821	0.6316	0.3190	6780
Std Dev	132	0.0065	0.0129	476



Carbon Fabric + 4412 Scrim	Max. load (lbsf)	Width (in)	Thickness (in)	Laminar Shear Strength (psi)
Specimen 1	2073	0.6365	0.3240	7540
Specimen 2	2112	0.6795	0.3320	7021
Specimen 3	2293	0.7140	0.3320	7255
Specimen 4	2272	0.6675	0.3380	7554
Specimen 5	2026	0.6875	0.3245	6810
Avg	2155	0.6770	0.3301	7236
Std Dev	120	0.0284	0.0059	325



Short beam shear results clearly show that the carbon laminate made with the additional layers of polyester carrier scrim did not act as a contaminant to the laminate properties by not resulting in a poorer laminar shear strength compared to the carbon only control. In fact there is evidence to suggest that the addition of the carrier scrim actually enhances the laminar shear strength by 6.7% on average.