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PROJECT FINAL REPORT

FLAX FIBRE MAT ASSESSMENT

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EXECUTIVE SUMMARY

Using an off-the-shelf thermosetting polyester resin and flax mat produced from a commercially available disposable bagging resin infusion process, 3-3.5 mm thick flax panels were successfully manufactured. The flax panels had a calculated fibre content by volume of 15%-20%. Glass panels were made using a hand lay-up process to achieve an equivalent fibre volume to the flax panels. A test program was undertaken to determine the panels' performance. As the flax fibres were semi-aligned, the tests where outcomes could be affected by anisotropy were tested in both the parallel (strongest) and perpendicular (weakest) orientation. Tables 1 and 2 display the averaged results for each of the properties investigated.

Table 1: Physical Properties of Flax and Glass Specimens

Property	Glass	Flax	Units
Acoustic Damping	Marginally worse than Flax	Marginally better than Glass	
Water Absorption			
2 hrs	0.11	0.36	% Weight Increase
2+24 hrs	0.18	1.30	
Surface Flammability	82	170	
Chemical Resistance			
Benzene	-3.72	-2.97	% Weight Change
Diesel	0.05	0.17	
Ammonia Solution	-0.56	0.96	
Operating Temperature	Slight darkening	No visible change	

Table 2: Mechanical Properties of Flax and Glass Specimens

Property	Glass	Flax Parallel	Flax Perpendicular	Neat Resin	Units
Heat Distortion	96.8	78.7	75.7	69.4	C
Charpy Impact	66.6	6.9	3.2		kJ/m^2
Specific Value	*45.9*	*5.8*	*2.7*		*kJ/m^2 cm^3/g*
Flexural Strength	211.5	70.5	37.1	68.9*	MPa
Specific Value	*145.9*	*60.7*	*30.9*	*57.5*	*MPa cm^3/g*
Flexural Modulus	8.5	4.5	4.2	4.1	GPa
Specific Value	*5.9*	*3.9*	*3.5*	*3.4*	*GPa cm^3/g*
Tensile Strength	138.0	31.4	16.1	46.9*	MPa
Specific Value	*95.2*	*27.1*	*13.4*	*39.1*	*MPa cm^3/g*
Tensile Modulus	10.3	6.4	4.6	4.3	GPa
Specific Value	*7.1*	*5.5*	*3.8*	*3.6*	*GPa cm^3/g*

* Values were obtained from the manufacturer's specifications and not through testing

As expected from a non-optimised material, the flax panels displayed a number of decreased mechanical properties in comparison to glass. When the specific properties were compared, the flax specimens' performance as compared to glass was improved, but the results were still much lower than considered to be appropriate for ground transportation parts unless they are used in a non-structural application such as air ducts and headliners.

The flax panels' performance in the impact, tensile and flexural strength categories needs to be improved for the material to be adopted for structural applications. This will require further investigation of the following: fibre quality and consistency, fibre/matrix bond, resin to fibre compatibility, shive separation techniques (fibre cleanliness) and mat manufacturing methods.