

Numerical modelling of Hybrid polymer composites for selected automotive parts

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ABSTRACT

Over the recent years development of composites has taken a huge leap forward and one of the main contributing factors for this is the reduction in weight achieved along with retaining equal or greater levels of mechanical properties compared to conventional materials. Environmental awareness has stolen the lime light in the past few years making eco-friendliness an important requirement of every new development. In order to adapt to this, researchers have been introducing natural fibers as a reinforcement, giving rise to hybrid composites. In this study, hybrid composites made from flax and glass fibers are evaluated and the results obtained are compared with the results obtained via simulations.

OBJECTIVES

The main objective of this study was to develop a hybrid composite with 8 layers in total and a varying stacking sequence of the flax and glass fiber fabrics, test the samples and compare the results obtained with the results obtained via simulations performed using ANSYS and develop composite beams which can be used to make selected automotive parts and be subjected to further testing.

Experiment:

The various samples were created via the vacuum bagging process and were tested for their

- Tensile strength
- Inter Laminar shear strength (ILSS)
- Low velocity drop weight impact

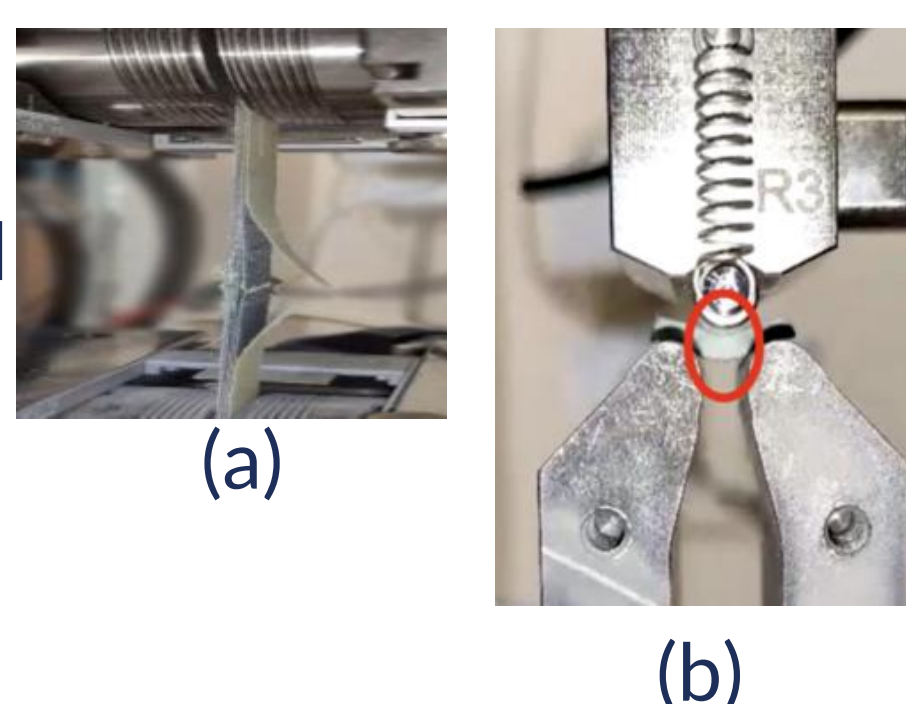


Fig 1. (a)Tensile testing (b) ILSS testing.

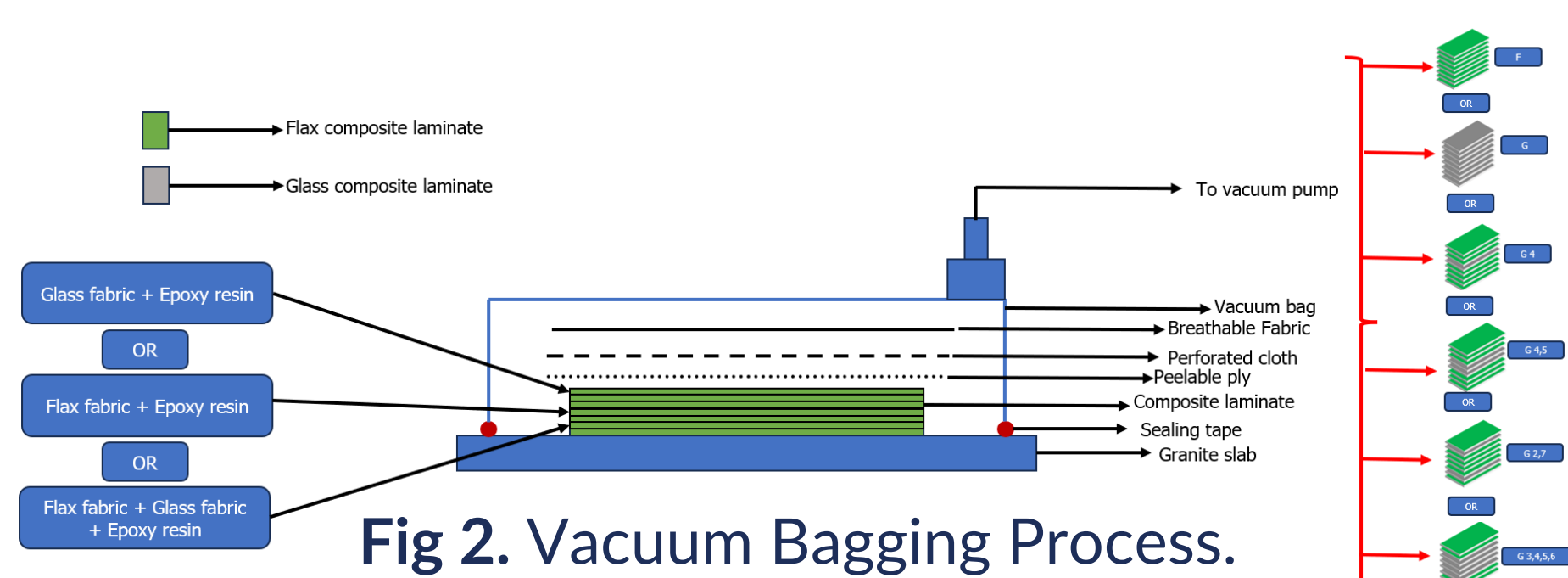


Fig 2. Vacuum Bagging Process.

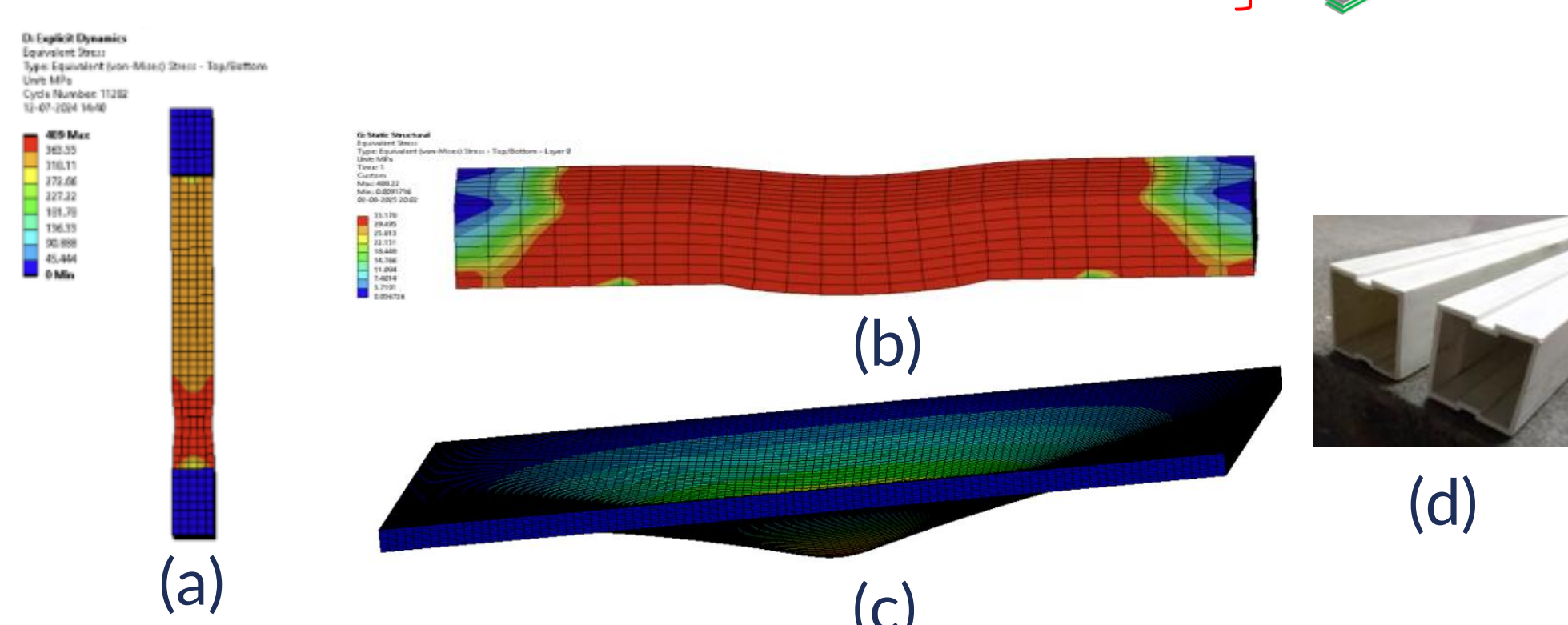


Fig 3. (a)Tensile test simulation (b) ILSS testing simulation (c) Low velocity drop weight impact simulation (d) Composite beams.

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CONCLUSIONS

The results of the tests revealed that the mechanical properties improved with the increase in the number of layers of glass fabrics. It was also observed that samples with 4 layers of glass fabrics had similar values as that of the samples made completely from glass fabrics. Upon comparing the tested tensile results with the simulated results it was seen that the percentage error varied between 3.5% to 8.7% . The percentage error varied between 0.1% to 6.25% when the results obtained from ILSS testing were compared with the results obtained after simulating the samples and when the results of the low velocity drop weight impact tests were compared with the simulated results it was seen that the percentage error for the deformation varied between 3.32% to 8.93% and the maximum force at impact varied between a minimum of 0.06% to 17.14%. These variation can be attributed to the tiny imperfections or voids which could have crept in while producing the composite samples.

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