

LOW VELOCITY IMPACT BEHAVIOR OF



THERMOPLASTIC GLASS FIBER

COMPOSITES STRENGTHEN WITH STAINLESS STEEL MESH LAYERS

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Abstract

absorption capability, metals Because of energy hybridization is proved to be an advantageous method for composite structures impact loading capacity. In the present

Results and discussion

While the [G⁴⁰]₂ reached perforation point under 30 J LVI energy, the hybridized laminate strengthen with metal mesh withstands the impact load showing a rebound

study, Low Velocity Impact (LVI) response of thermoplastic glass fiber Polypropylene composite laminates strengthening with stainless steel mesh is investigated.

Materials and production procedure

2/2 twill weave Glass/Polypropylene layers with the glass fiber weight fraction of 40% (G) and 60% (G), and stainless steel mesh (M) with the wire diameter of 0.7 mm were used to manufacture the hybrid composite laminates. Three different samples with the stacking sequence of $[G^{40}]_2$, $[G^{60}]_2$, and $[G^{40}/M/G^{40}]$ were fabricated using the air-cooled double-belt

laminating method depicted in Figure 1.

behavior. Evaluations revealed that the hybrid $[G^{40}/M/G^{40}]$

laminate penetrates under 50 J impact energy.



of damage propagation under LVI Assessments loadings revealed $[G^{40}]_2$ undergoes higher damage extents under relatively lower impact energies. As Figure 4 represents, instead of local damages, the hybrid composite laminate globally deforms under the applied 30 J impact energy.









Figure 4. Side view of composite laminates after 30 J LVI loading, (a) $[G^{40}]_2$, (b) $[G^{60}]_2$, (c) $[G^{40}/M/G^{40}]_2$

Figure 1. Air-cooled double-belt fabricating machine used for laminate fabrication at Innovative Composite Products (ICP) Inc.

Impact test procedure

LVI tests were performed on



Conclusion

> Hybridized composite laminates could outperform the

plain ones under the same LVI energies.

> Penetration energy is improved compared to the non-



 $mm \times 150 mm$ in accordance with

ASTM D7136 [1]. Figure 2

depicts the Instron 3940 impact

machine used to run the LVI tests

with the applied impact energies

ranging from 15 J to 75 J.

Figure 2. Instron 3940 drop weight impact machine.



hybrid composites.

 \succ The stainless steel mesh layers could change the damage response of the laminates under LVI loading

conditions, particularly before the perforation point.

References

[1] ASTM D7136 / D7136M – 15, Standard Test Method for Measuring the

Damage Resistance of a Fiber-Reinforced Polymer Matrix Composite to a Drop-Weight Impact Event, ASTM International 2015