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# LOW VELOCITY IMPACT BEHAVIOR OF THERMOPLASTIC GLASS FIBER COMPOSITES STRENGTHEN WITH STAINLESS STEEL MESH LAYERS

I-C-P
Innovative Composite Products

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# Outline

- Introduction
- Materials and production procedure
- LVI test process
- Results and discussion
- Conclusions

# Introduction

- Hybridization is proved to be an advantageous method for composite structures impact loading capacity.

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

# Materials and production procedure

Comingled woven Glass/PP
+
Stainless steel mesh 0.7 mm wire diameter

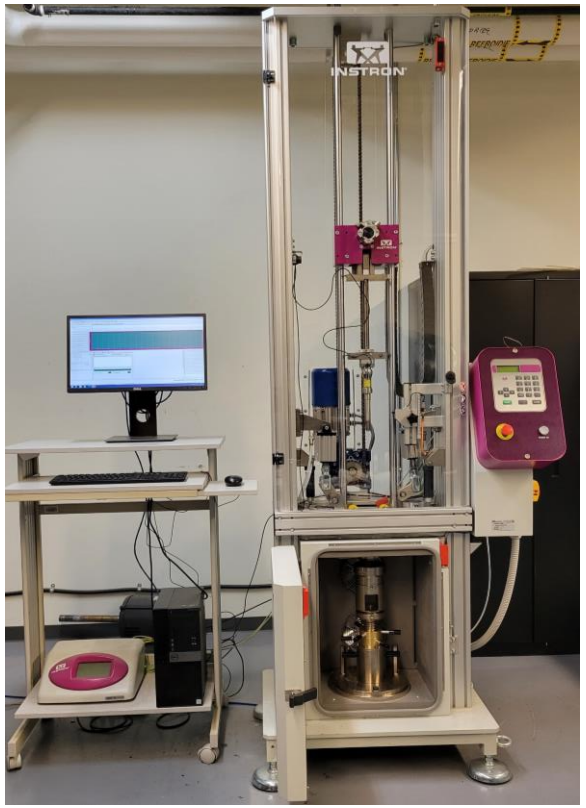
Heating elements

Final fabricated laminate
$[G^{40}]_2$, $[G^{60}]_2$, $[G^{40}/M/G^{40}]$

Air-cooled double-belt fabricating machine at Innovative Composite Products (ICP) Inc.

# LVI test process

- Samples with dimensions of 100 mm × 150 mm were subjected to LVI energies ranging from 15 J to 75 J, in accordance with ASTM D7136 [1].

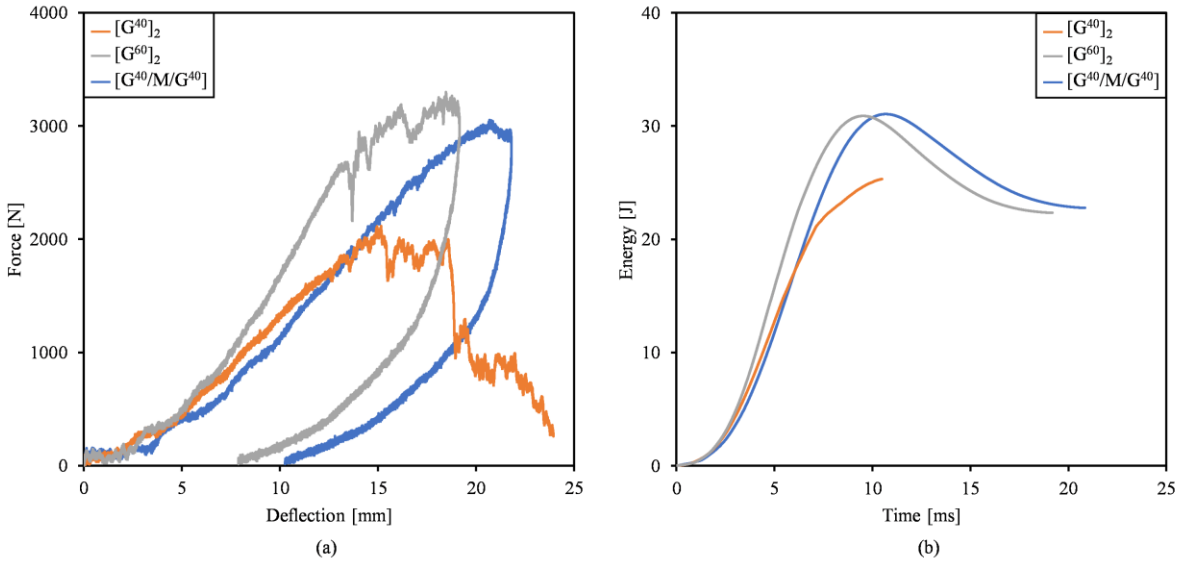



Instron 3940 drop weight impact machine.

[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

# Results and Discussion

- Evaluations revealed that the hybrid [$G^{40}$/M/$G^{40}$] laminates penetrates under higher LVI energies.
- Hybrid composite laminates globally deform under the applied LVI loadings.




LVI response of hybrid and non-hybrid composite laminates under 30 J impact test, (a) force-deflection curve, (b) energy-time diagram


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

# Conclusion

- Hybridized composite laminates could outperform the plain ones under the same LVI energies.
- Penetration energy is improved compared to the non-hybrid composite laminates with same fiber volume fractions.
- The stainless steel mesh layers changes the damage response of the laminates under LVI loading conditions, particularly before the perforation point.