Vapor Deposited Thin Silane Interphases and Capstone Panel Design

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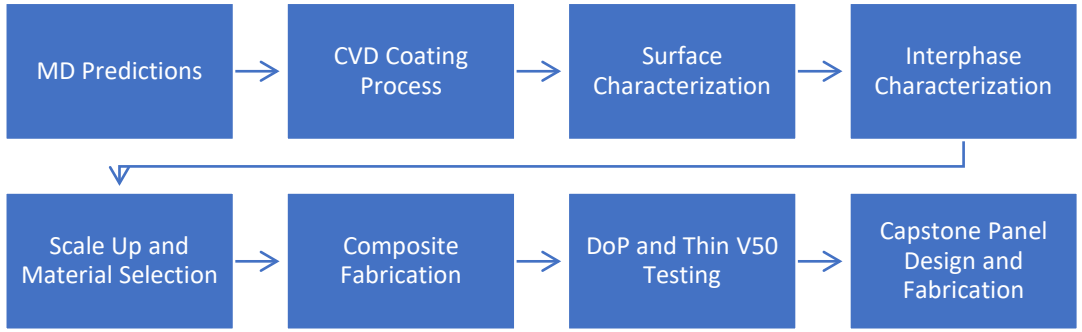
Key Goals and Technical Approach

- Large database of new resin/interface combinations has been developed for material design and optimization with IFSS varying by 50-115 MPa, resin yield from 61-164 MPa, and resin energy absorption 70-120 J/cc
- Design a functionally graded composite from the materials properties to improve ballistic performance



Weave

agy

strength in materials
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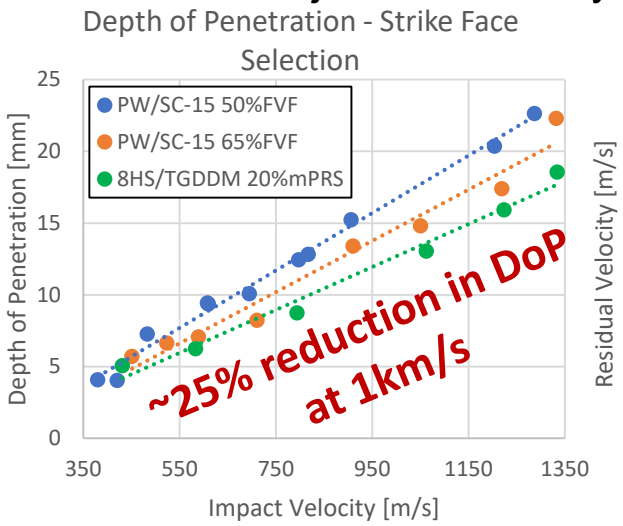
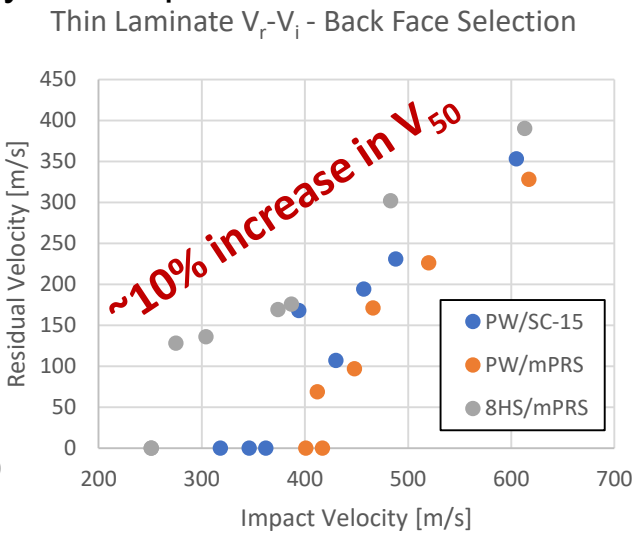
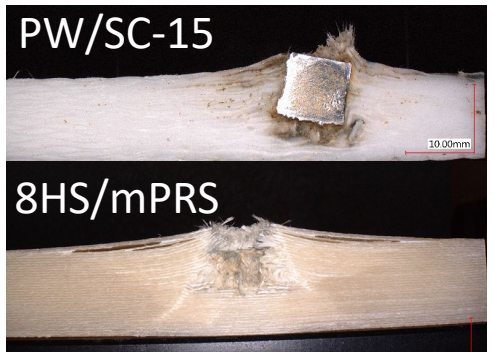
Major Results, Key Accomplishments

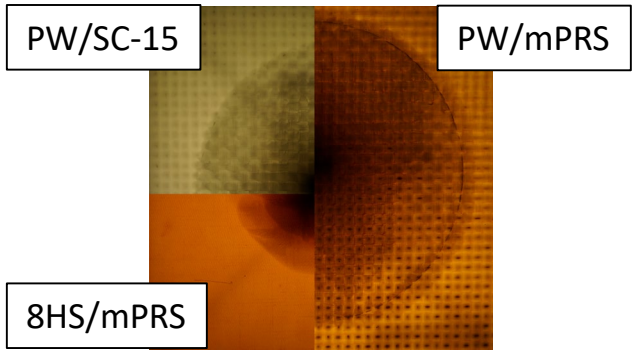




Materials by design by selecting IFSS/Resin/Architecture can vary the V50 from 250-400 m/s and extend delamination from 3" to over 6" in thin laminates



Sectioned DoP Samples



¼" V_{50} Sample Delamination

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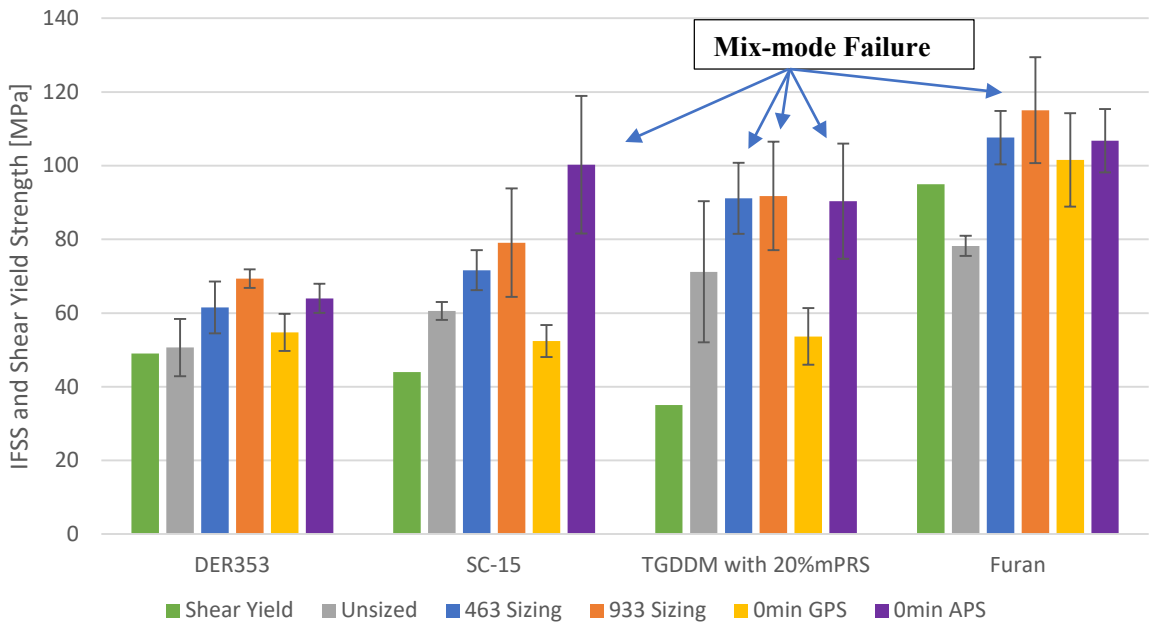
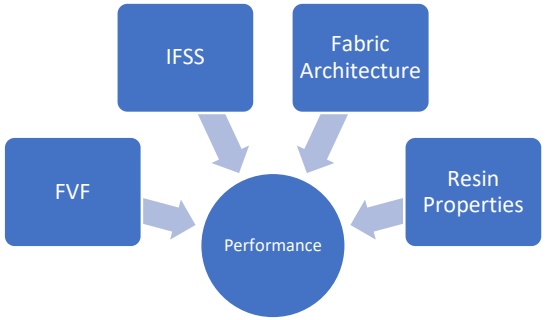
Transitions



- Fiber/matrix Interface Database
- Test methodology for IFSS
- CVD Silane Deposition Process
- CVD process to scale
- Conference Proceedings



- Kubota, M., Deitzel, J. M., & Gillespie Jr, J. W. Role of Surface Functionality and Polyamic Acid in Carbon Fiber/PEI Interface.
- Kubota, M., Chowdhury, S., Deitzel, J. M., Gillespie Jr, J. W., Palmese, G. R. (2020). Tailoring the S-2 Glass/Epoxy Interface Properties Through Chemical Vapor Deposition of Silane Adhesion Promotors. In *Proceedings of the American Society for Composites—Thirty-fifth Technical Conference*.

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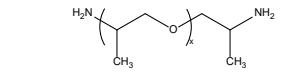
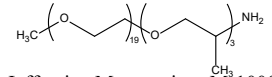
Functionally Graded Capstone Panel Design

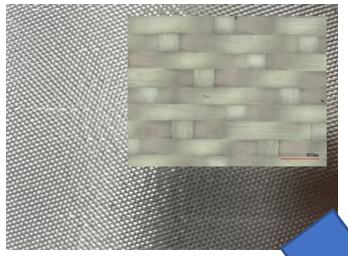


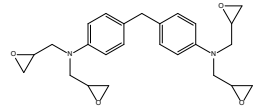
Jeffamine Diamines D-230 x ≈ 2.5



Jeffamine Monoamines M-1000

8HS (933)

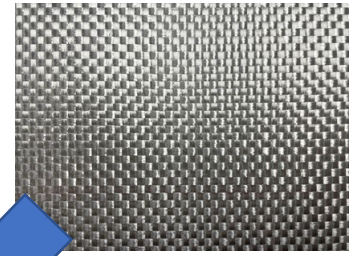


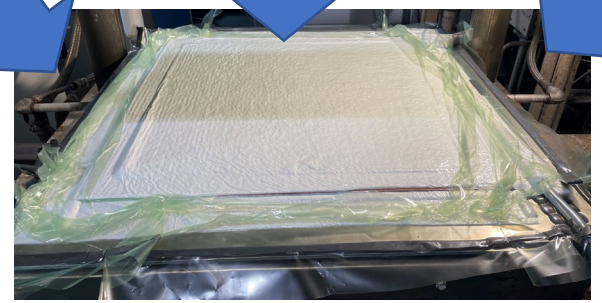


Tetraglycidyl of Diaminodiphenymethane (TGDDM)

TGDDM with 20%mPRS

PW (463)





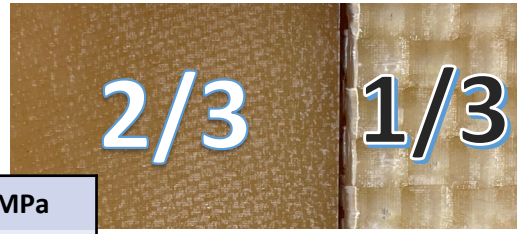
Functionally Grading Design

Strike face: High penetration resistance and crush strength (DoP)

Back face: Energy dissipation through delamination (Thin Laminate V_{50})

Final Capstone Design

Strike Face 8HS/mPRS



Back Face PW/mPRS

IFSS	**92 MPa**
FVF	**65%**
σ_y	**61 MPa**
Energy Absorption	**71 MJ/m^3**

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