High Rate Test Methods for Fiber-Matrix Interface

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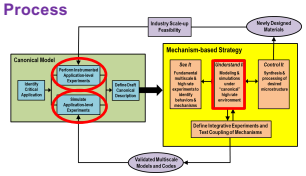
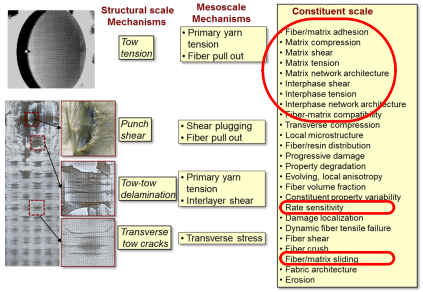
Enterprise for Multi-scale Research of Materials

How We Fit

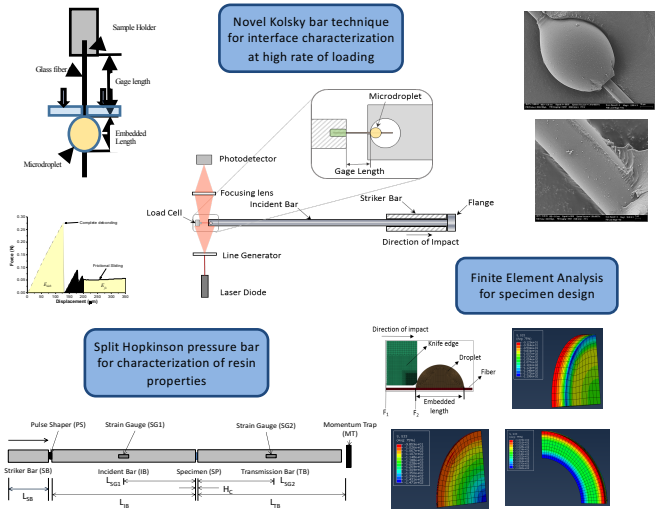
Materials-by-Design Process



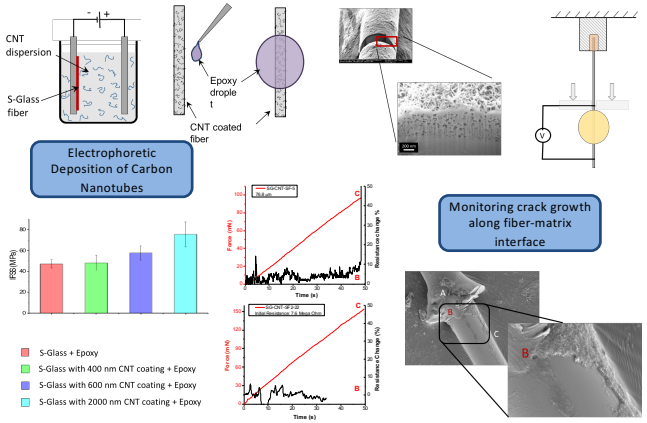
Mechanism-based Approach



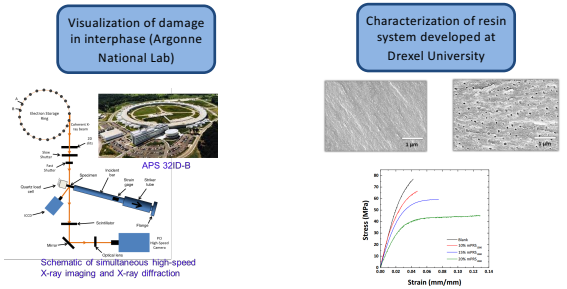
Technical Approach



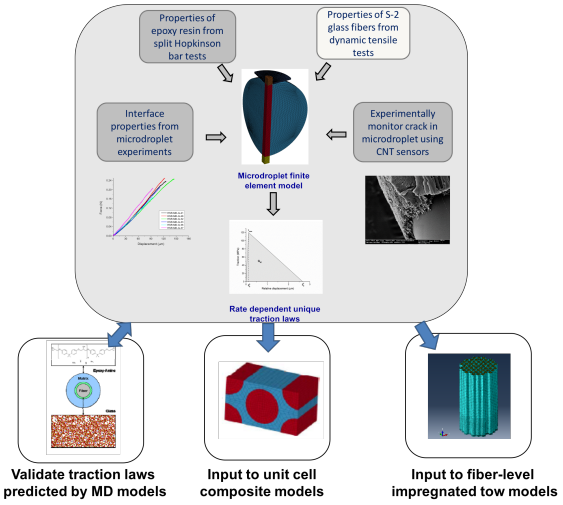
Key Accomplishments



Future Directions in 2017



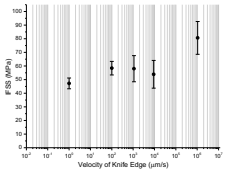
Key Goals



Major Results

- S2 Glass Fiber
- DER353 epoxy resin with silane sizing

Characterization of fiber-matrix interface properties over six decades of loading rates

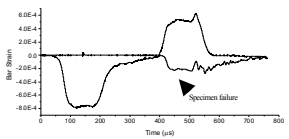


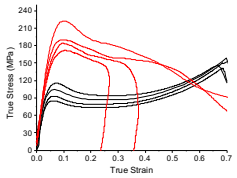
	Velocity (μm/s)	IFSS (MPa)	COV (%)	Specific Energy Debond (J/m²)	COV (%)
Quasi-Static Test	1	47.8	8	760	45
High Rate Test	10^6	80.6	15	1950	44

High Rate Properties of S-2 Glass fibers

Gage length (mm)	Strain Rates (1/s)	Tensile Strength (GPa)
25.4	0.002	3.4 ± 0.5
8		3.7 ± 0.5
8	500	4.8 ± 0.5
4	900	5.1 ± 0.5
2	1800	5.4 ± 0.5

Donut specimen to load the specimen at high rate of loading up to failure





Impact

- Improved understanding of energy absorbing mechanisms will have broad applications in composites
- Critical element of materials-by-design framework for composite materials under high rate loading
- Will lead to improved protection materials while decreasing the cost and time for development of new lightweight energy absorbing composite materials

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