Micromechanical Modeling of Punch Shear and Punch Crush of Unidirectional S-2 Glass Composites

Key Goals and Technical Approach

- Punch crush and punch shear and in-plane tension are the energy dissipating damage mechanisms
- Key goals are stochastic micromechanical modeling of the punch shear and crush considering fiber fracture, fiber-matrix debonding, and non-linear matrix deformation
- Developing model validating punch shear and punch crush experiments at sub-millimeter length scales
- Predict the MAT162 Properties and Parameters from the stochastic micro-mechanical models
- Develop a materials by design Framework

Major Results, Key Accomplishments

Punch Crush Experiments
- Depth of Penetration
- Crush of Composites
- Perforation
- Punch-Shear & Tension

Punch Shear Experiments
- Punch Shear Fracture Surface
- Punch Shear Strength vs Annulus Width

Punch Shear Fracture Surface

Average Punch Crush Strength, PCS, MPa.

Annulus Width, a, µm.

Punch Crush Strength = 1400 MPa

Average Punch Shear Strength, PSS, MPa.

Annulus Width, a, µm.

Punch Shear Strength vs Annulus Width
Transitions (materials, codes/tools, legacy publications)

- Micromechanical Models of Unidirectional Composites for Different Fiber Volume Fractions
- Stochastic Framework for Micromechanical Predictions of MAT162 Properties and Parameters