**MOTIVATION AND OBJECTIVES**

- Quasi-static punch shear tests (QS-PST) can be used to effectively determine the materials capability of dissipating energies during QS-penetration.
- A QS-penetration model (QS-PM) of ballistic penetration has recently been developed which can predict the ballistic limit of a composite-projectile pair using an energy approach.
- The objective of this research effort is to apply the QS-PM methodology for different composite materials made from 2D and 3D fabrics and different resin systems.

**BASELINE S2/SC15 SECTIONS**

- Sections of 50 caliber QS-PST on 22 layer S2/SC15 composite.

**BASELINE S2/SC15 RESULTS**

- Load-displacement data is then used to define the Penetration Resistance Envelopes.

**3D 1000oz ZZ S2/FCS2 SECTIONS**

- Sections of 50 caliber QS-PST on 4 layer S2/FCS2 composite.

**MATERIALS**

- Baseline PW S-2 Glass/SC15
  - 22 Layers
- 3D 100oz ZZ S-2 Glass/FCS2
  - 4 Layers
- PW S-2 Glass/VPS2
  - 20 Layers
- PW E-Glass/VPS2
  - 20 Layers
- Projectile, 50cal Cylinder
  - \( m_p = 13.4 \text{ gm} \)

**BASELINE S2/SC15 SECTIONS**

- Support Span (D) and Punch diameter Ratios, \( D_p/D_s \).
- Load-displacement data is then used to define the Penetration Resistance Envelopes.

**BASELINE S2/SC15 RESULTS**

- Load-displacement data is then used to define the Penetration Resistance Envelopes.
PENETRATION RESISTANCE OF THICK-SECTION COMPOSITES: EFFECTS OF FABRIC ARCHITECTURE AND MATRIX MATERIALS

Continued

3D 100oz ZZ S2/FCS2 RESULTS

S2/VPS2 RESULTS

EG/VPS2 RESULTS

S2/VPS2 SECTIONS

Sections of 50 caliber QS-PST on 20 layer S2/VPS2 composite.

EG/VPS2 SECTIONS

Sections of 50 caliber QS-PST on 20 layer EG/VPS2 composite.

SUMMARY OF RESULTS

CONCLUSIONS

- The QS-PM developed for baseline PW S-2 Glass/SC15 can be used for 3D 100oz ZZ/FCS2 composites.
- The PW S-2 Glass/VPS2, and E-Glass/VPS2 load-displacement are very different than the baseline, and further data reduction methodology is needed.
- The QS-PM model is applied to S-2 Glass/VPS2 & E-Glass/VPS2 composites and approximate ballistic limit determined.

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