

Optimal V-Notched Shear Testing of Composite Laminae and Laminates

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Optimal Shear Test of Composites: What attributes come to mind?

Within the “test section”:

- **Uniform state of shear stress**
- **“Pure shear” - no other stress components**
- **Higher magnitude of shear stress than other regions of the specimen**
- **Shear failure produced in test section**

Comparison of V-Notched Shear Tests: Test Fixtures and Specimens



V-Notched Beam
"Iosipescu" Shear
ASTM D5379



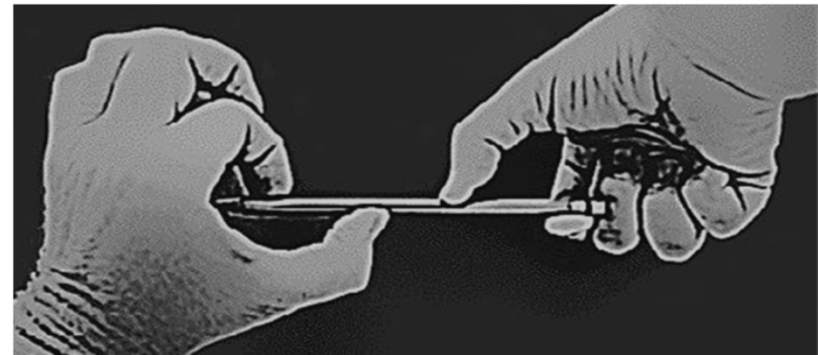
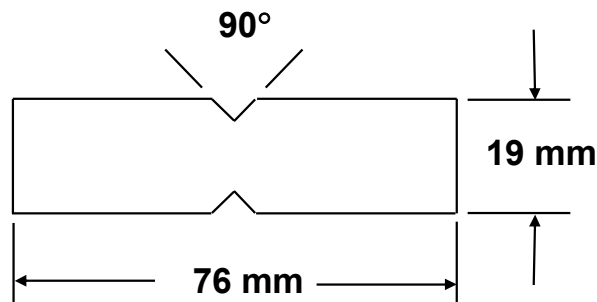
V-Notched Rail Shear
ASTM D7078



Combined Loading
Shear

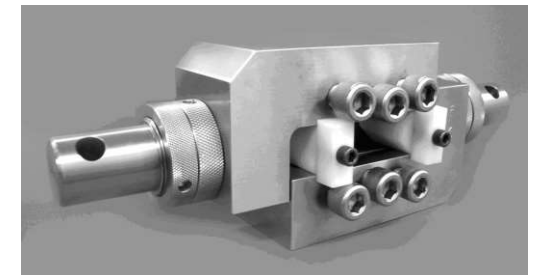
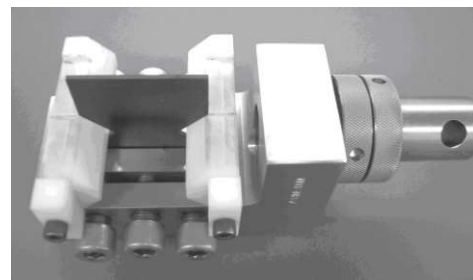
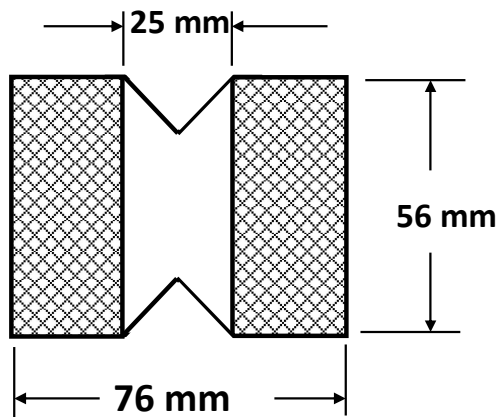
Iosipescu (V-Notched Beam) Shear Test: ASTM D5379

- 76 mm long x 19 mm wide specimen
- Opposing 90° machined V-notches
- Asymmetrical four-point flexure loading
- In-plane and interlaminar shear testing



V-Notched Rail Shear Test: ASTM D7078

- Standardized in 2005 by ASTM
- 76 mm x 56 mm notched specimen
- Same notch configuration as Iosipescu specimen
- Increased gage section (compared to Iosipescu)
- Face-loading allows testing of higher shear strength laminates

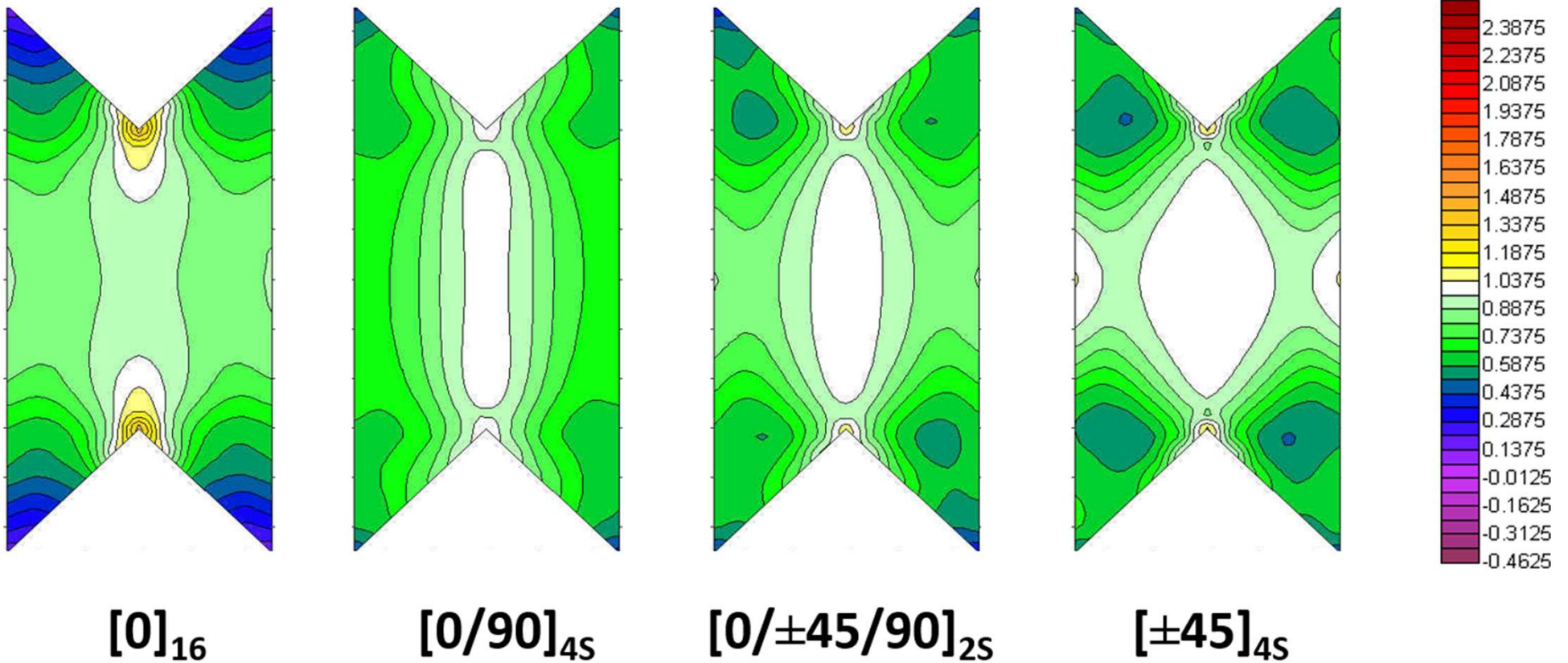


Combined Loading Shear Test (In Process of ASTM Standardization)

- Retains face loading of current D7078 V-notched rail shear test
- Introduce edge loading similar to D5379 Iosipescu shear test
- Specimen length increased to 127 mm
- Allow shear testing of thicker, higher shear strength composite laminates



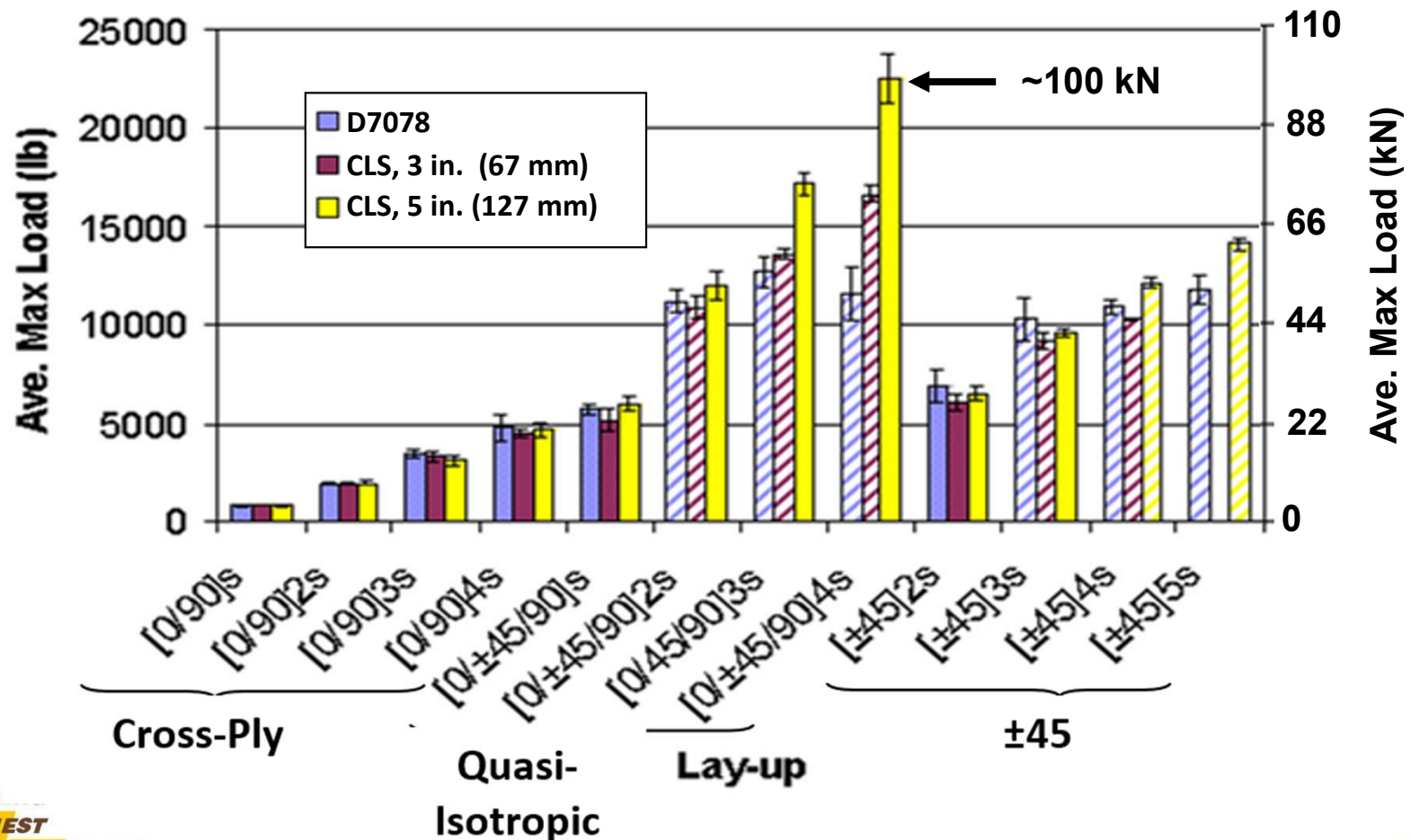
Shear Stress Distribution in Test Section Area: V-Notched Shear Tests



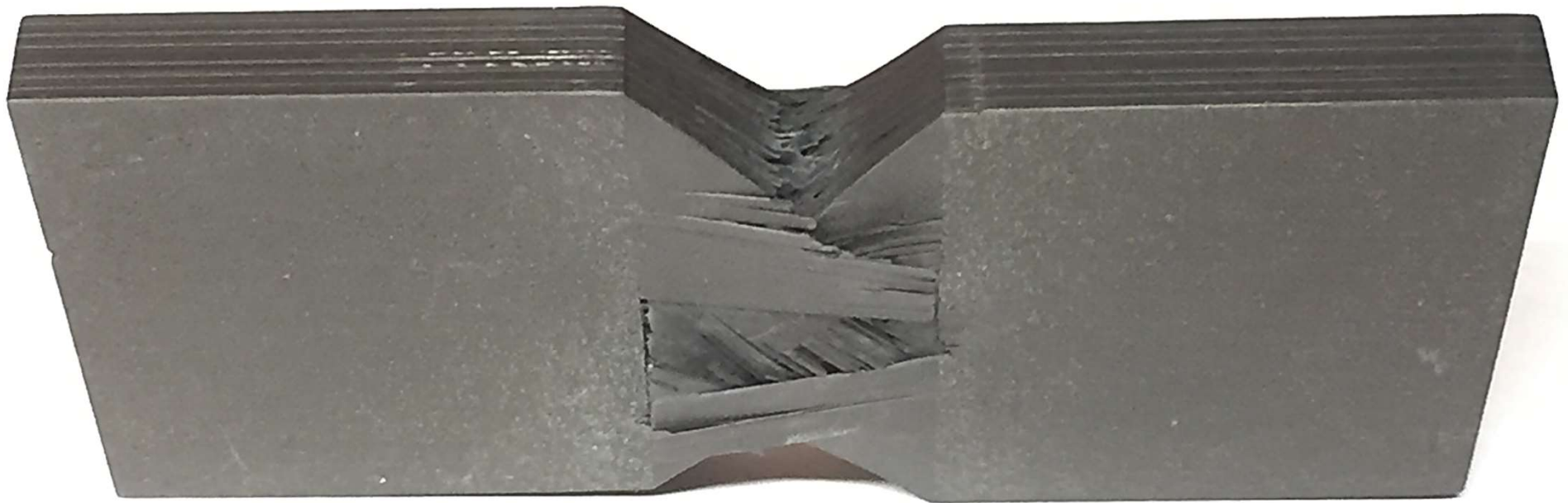
Results from finite element simulation, AS4/3501-6 carbon/epoxy

Comparison of Loading Capabilities: V-Notched Rail Shear Tests

Shear load capability increased significantly using
Combined Loading Shear (CLS) test method



Shear Failure of Quasi-Isotropic Combined Loading Shear (CLS) Test Specimen



IM7/8552 carbon/epoxy, ~10 mm specimen thickness