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ABSTRACT

Test Methods and establishing a Database of High Strain Rate properties for composite materials are essential.

Ballistic impact of composite armor has multiple failure modes

- TTC (Through Thickness Compression)
- TTT (Through Thickness Tension)
- TTIS (Through Thickness Interlaminar Shear)
- IPC (In-Plane Compression)

Composites have different failure modes

- Mode I (Opening)
- Mode II (In-Plane Shear)
- Mode III (Out of Plane Shear)

Objective

- Conduct a literature review of existing test methods and failure modes for TTT, TTIS, and Toughness
- Establish test methods and refine the data reduction for those methods
- Create a database of properties at high strain

PRELIMINARY METHODS

Preliminary Ideas for this test is to take existing test standards and convert them to be tested using the Split Hopkinson Pressure Bar. The test methods being look at are

- ASTM D 2344 (Short-Beam Method),
- ASTM D 3846 (In-Plane Strength of Reinforced Plastics).

From the test methods the required data to be obtained is X_T , X_C , S_{XY} , G_{IC} , G_{IIC} . This will be done by modification of the SHPB and samples

X_T = Max Tensile Strength

X_C = Max Compression Strength

S_{XY} = Shear Strength

G_{IC} = Fracture Toughness for Mode I Loading (Opening)

G_{IIC} = Fracture Toughness for Mode II Loading (In-Plane Shear)

TESTING PROCEDURE

Literature Review

- Identify existing test methods
- Develop concepts for new methods

Evaluate Test Methods

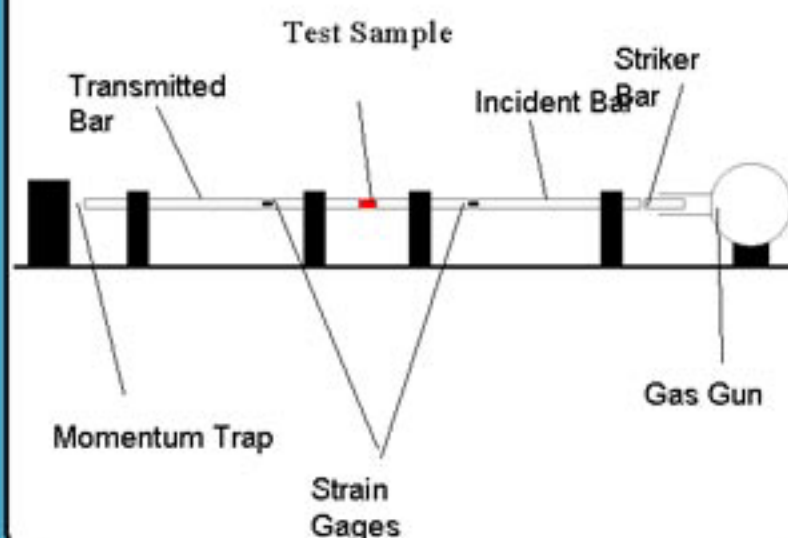
- Quasi Static Tests
- Low Velocity Impact
- High Strain Rate

Refine Test Methods

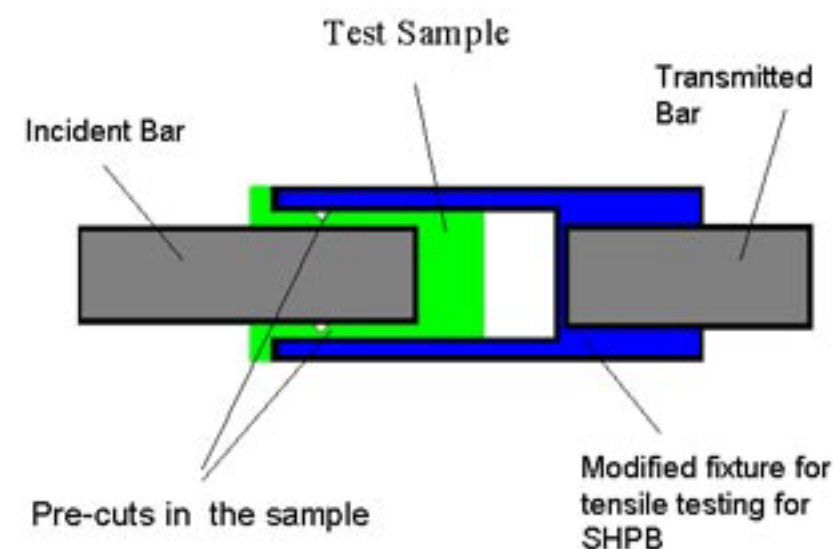
- Improve Test Fixture
- Data Reduction Procedures

Database Development of Properties

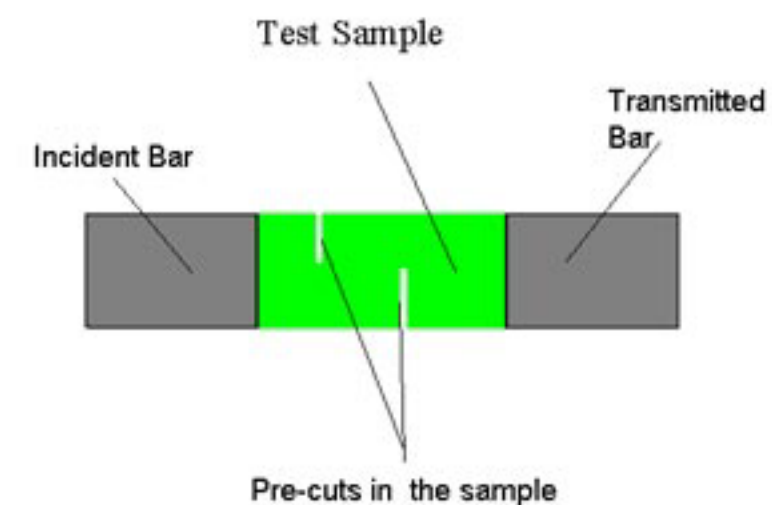
Split Hopkinson Pressure Bar (SHPB)



Test configuration for testing for G_{IC} and X_T using the SHPB



Test configuration for S_{xy} , X_C , and testing for using the SHPB



Idea of testing for G_{IIC} using the SHPB

