

Manufacturing Test Fixtures in Reliability and Failure Analysis

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Background

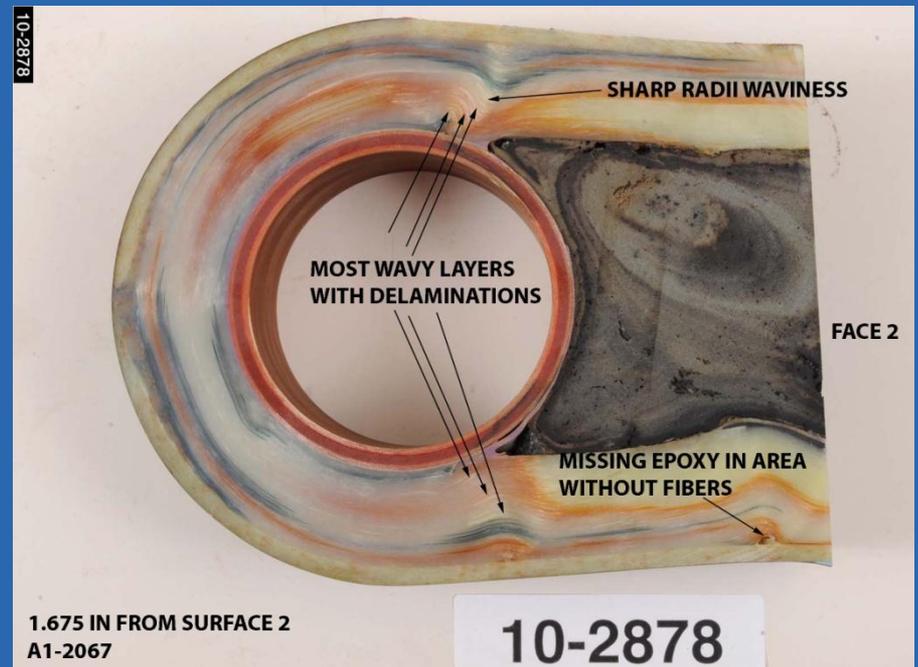
- With the evolution of material, test equipment must also evolve.
- Test equipment is no longer ready to use right out of the box.
- Modifications can range in a spectrum of complexity.
- Most important aspect is validity of test and adaptability.

Introduction

- The most important part of test fixture manufacturing is understanding the goal and material to be tested.
- Completing free body diagrams of new fixtures is the easiest filtering factor for ideas.

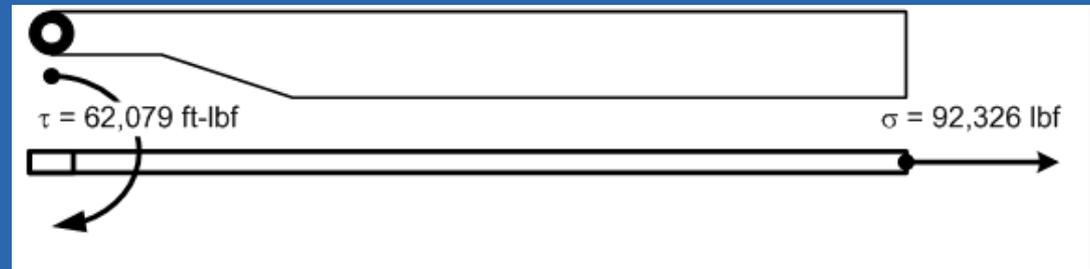
Rotor Blade

- Rotor blade uses E-glass composite as main structure.
- Waviness in composite must be classified to determine its affect.
- Creating the defect in a testable coupon presents a problem.



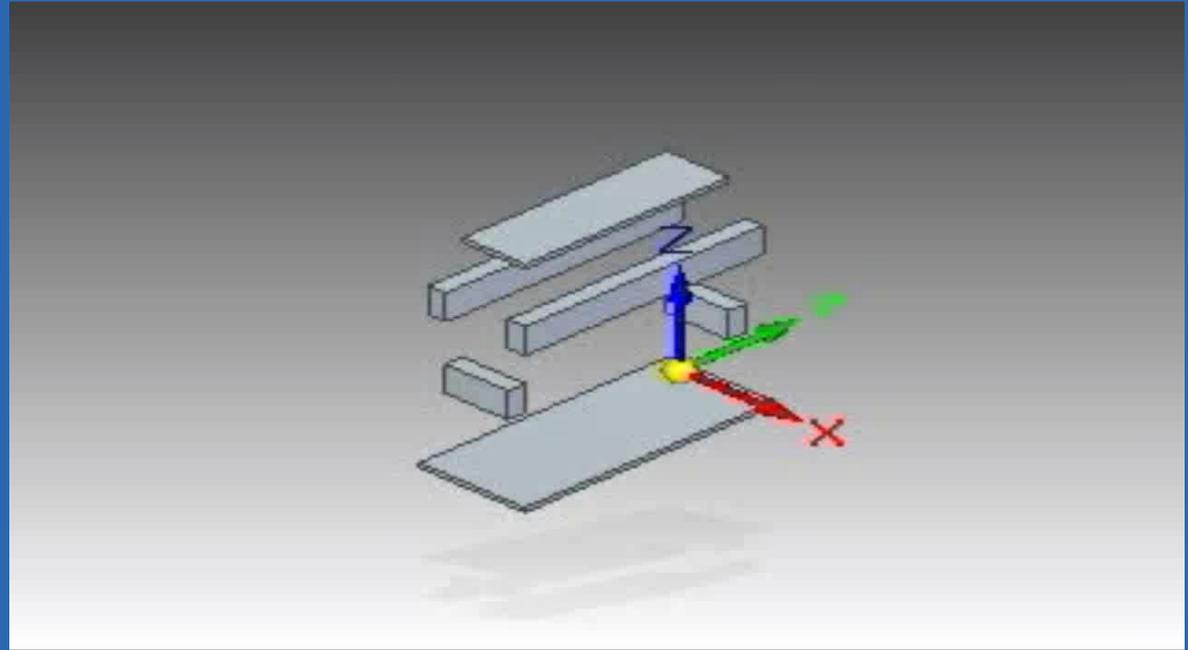
Free Body of Blade

- To determine the tests that should be applied to the coupons, free body diagram was created of the blade to see the loading.



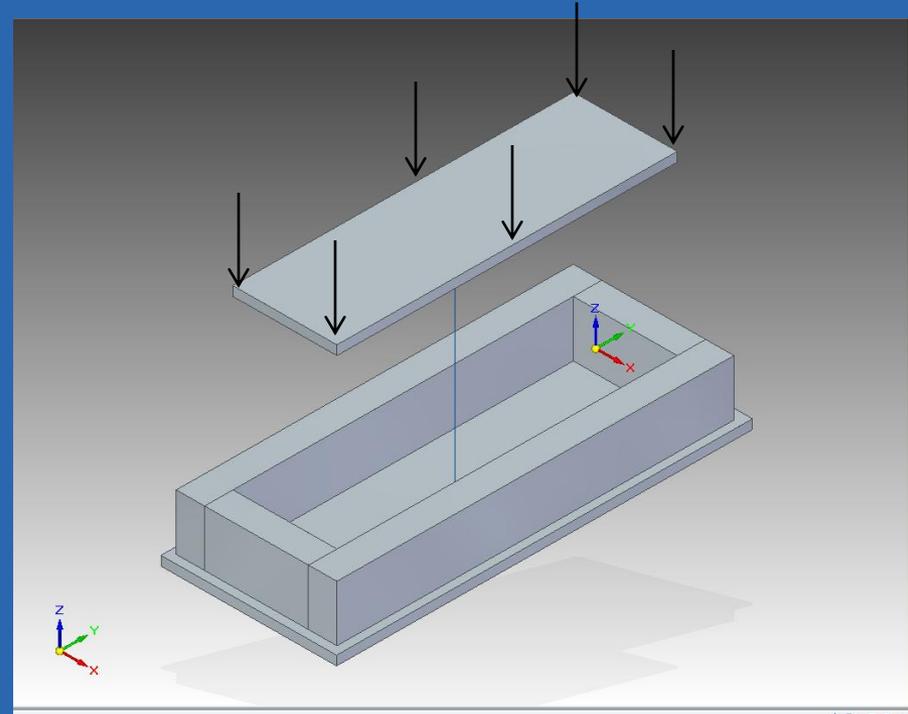
Composite Mandrel

- Specimen required a controlled defect be placed in material.
- Must be linear and square on all sides.



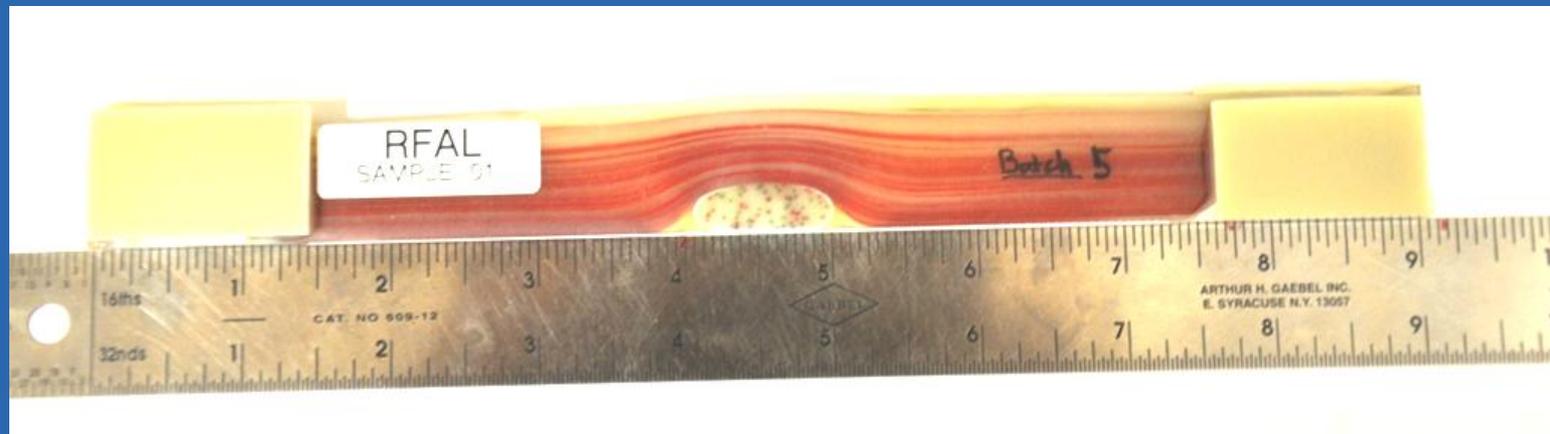
Free Body Diagram

- In order to form a rectangular sample a pressure plate was added to the top of the specimen.
- The pressure plate allows even distribution of force along the top of the brick during cure.



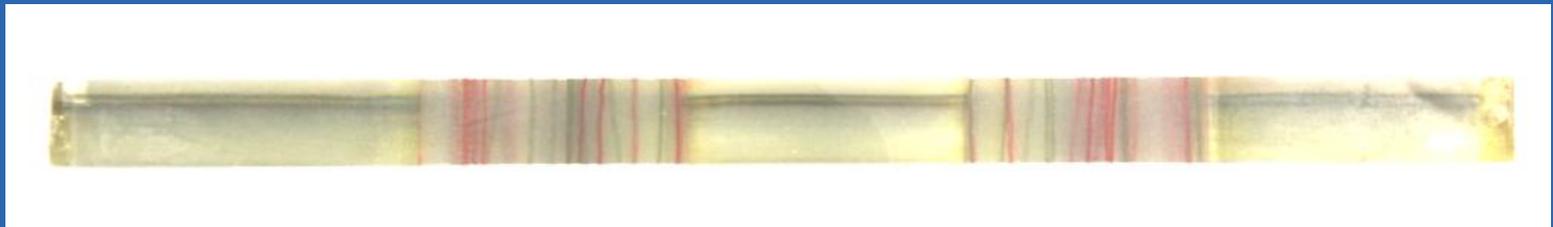
Product of Solution

- In the end the final product was exactly what was needed to remain within standards.



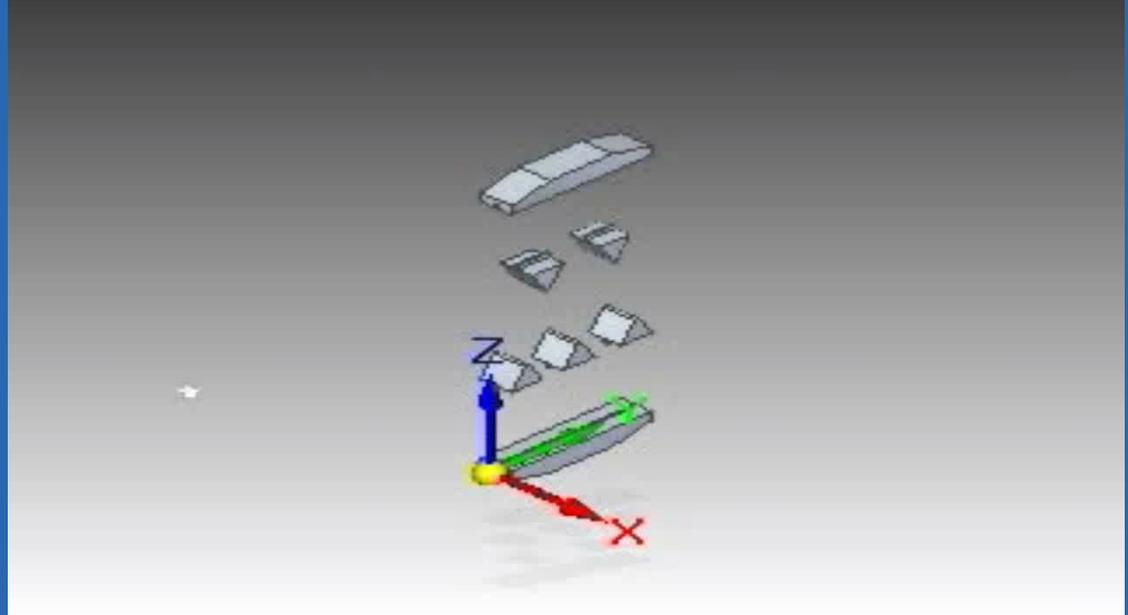
Shear Test Coupon

- In order to find the affects of sear on the defect a coupon had to be designed to allow for multiple size defects in an awkward orientation.

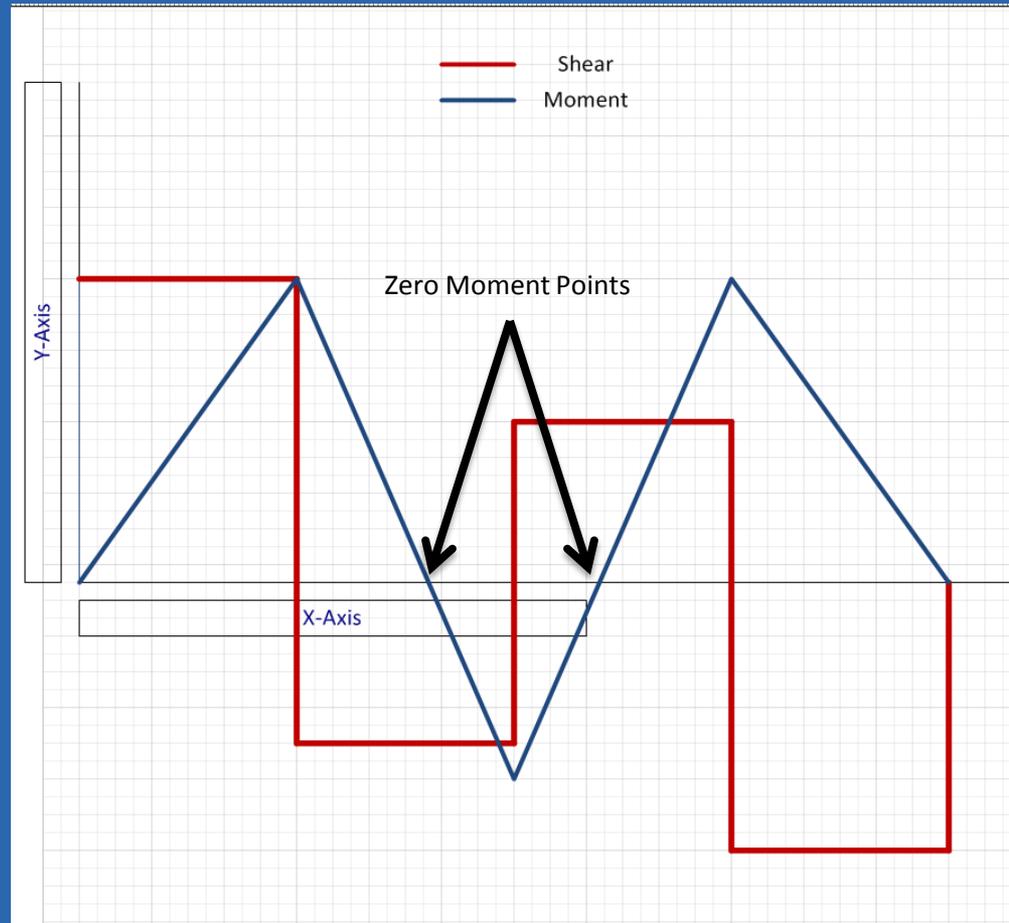


Shear Test

- Finding shear in an E-glass specimen.
- Five point bending offers an anomaly in the stress of a structure.
- The materials used completely transfer forces into the specimen.

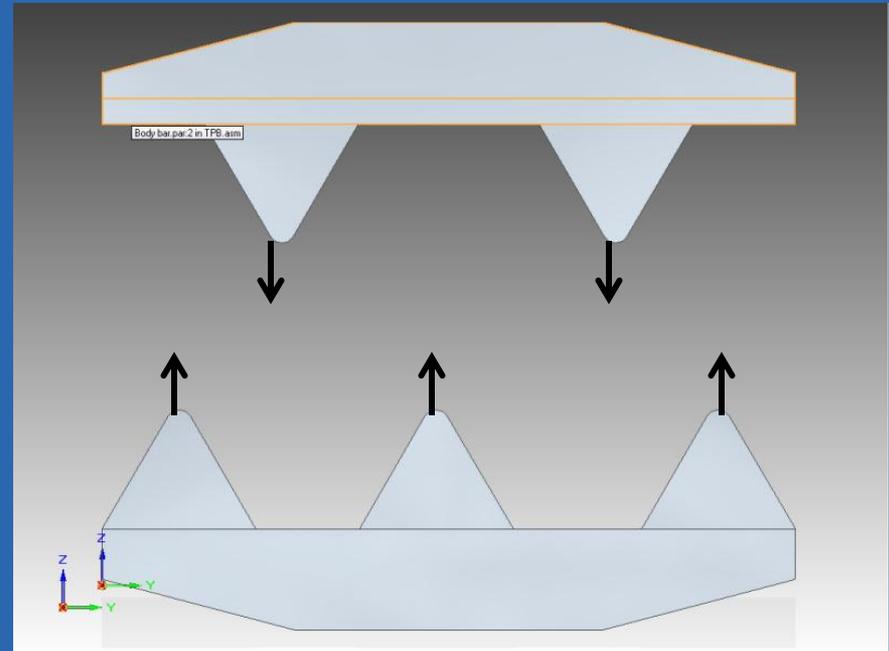


Shear and Moment Diagram



Shear and Moment Diagram

- This configuration of forces compressing a rectangular specimen creates two points in which the bending moment is zero and the shear stress is not equal to zero.



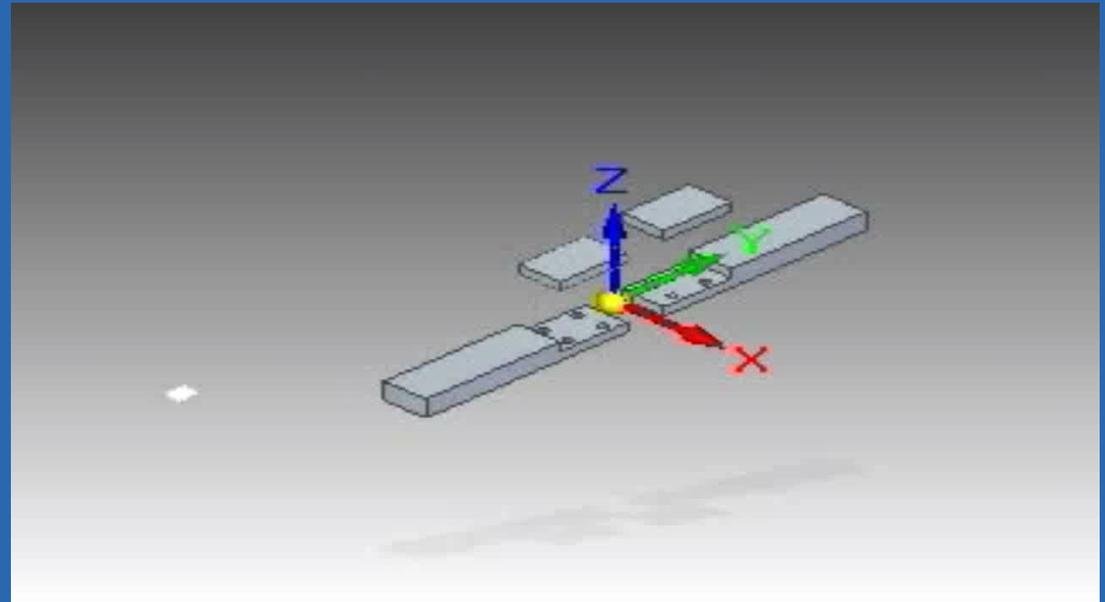
Ceramic Test Coupon

- New ceramic needs testing to determine its viability in the current market, before more money is put into perfecting it.



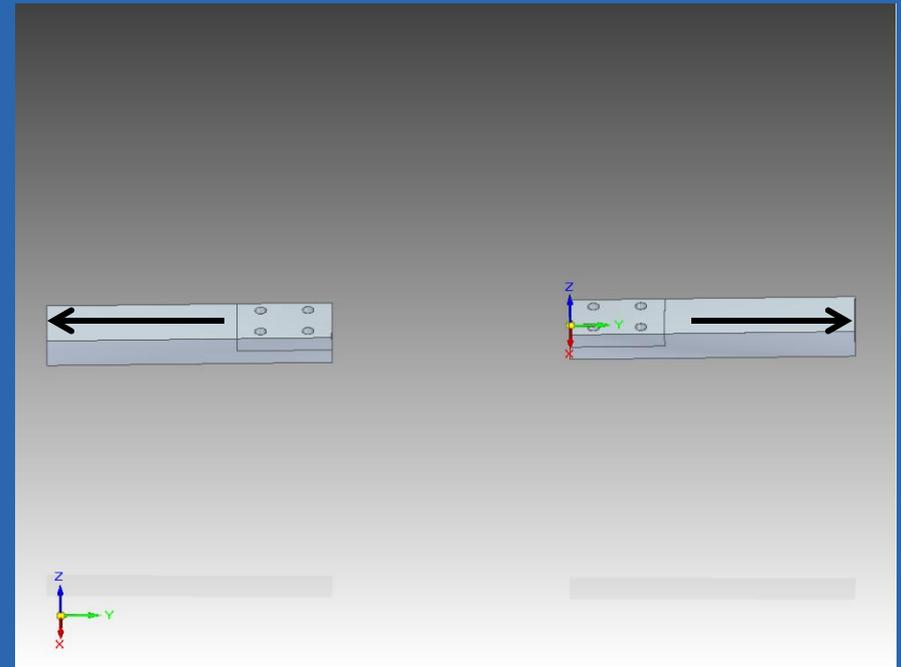
Ceramic Tensile Tests

- Ceramics are very fragile specimens.
- Test fixture can not induce any moment in the specimen.
- Can provide high grip strength over grip area.



Free Body Diagram

- With such a fragile specimen, we could not have a moment induced into the specimen from the grip fixture.
- Both grip plates are identical and held to tight tolerances to put all force generated into the specimen.



Machine Shop

- It is important to have manufacturing knowledge.
- Having the right tools for the job.
- Access to a machine shop allows for rapid prototyping and testing of ideas so that no time is wasted on something that doesn't work.

Questions

For Questions or comments
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