Course: Polymer Science (11546PB-2015)
Grade level: 10-12
Sources: Mississippi Polymer Science Instructors

Stressed-Skin Composites
Teacher Instructions

The PBA project is designed to be embedded into normal instruction, meaning that course instructors can guide students through the project during class time. All student products are due to the RCU by 5:00 PM on Friday, March 22, 2018. Instructions for submitting student products can be found in the PBA Manual (http://rcu.msstate.edu/Assessment/Performance-Based-Assessment.aspx).

Essential question: How does material type, skin arrangement, and delamination affect laminar composite performance?

Overview:
Students will evaluate skin material types, arrangements, and delamination effects on laminar composites using Young's Modulus and Modulus-to-weight ratio. Use ECI Composites Lab 2-1 (Stressed-Skin Composites), pp. 2-9 through 2-17 of the student manual as a guide.

Alignment:

- 21st Century Skills
  - CS6-13
  - CS 15

- College and Career Readiness Standards
  - SL.11.5 - Make strategic use of digital media in presentations to enhance understand of findings, reasoning, and evidence and to add interest.

- CTE Curriculum Unit

  - Unit 10

Time requirements:
2 weeks or as appropriate for each district's schedule

Materials and resources:
- Styrofoam insulation board, ½" thick x 18" x 48", can be purchased at home improvement store

    - Cut into strips to fit the skins (approx. 1.5-3 inches by 12-15 inches or as appropriate)
    - These need to be uniform for comparative testing
- Various skins (duct tape, masking tape, paper and glue, etc.)
- Wax paper
- 50 g weights
- Clamps to secure the strips to the table
- Yard stick or tape measure
- Safety goggles
- ECI Composites Lab 2-1 (Stressed-Skin Composites), pp. 2-9 through 2-17 of the student manual

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Student Instructions

Essential question: How does material type, skin arrangement, and delamination affect laminar composite performance?

Overview:

You are a research and development engineer for a leading laminar composites manufacturer. You are investigating materials and layer arrangements for a laminar composite beam to give the highest Young's Modulus with the lowest weight possible. In addition, you are evaluating the effects of delamination on product performance. You must create laminar composite test pieces from Styrofoam and at least 2 skins (tape, paper and glue, etc.). Create enough pieces to test the following parameters:

- bare foam beam (control)
- one-sided composite with the skin side up
- one-sided composite with the skin side down
- composite with skin on both sides
- composite with skin on both sides, but one side is delaminated in the center
    - test delaminated side up
    - test delaminated side down

You must be able to identify which material is the strongest by placing weights on an unsupported end through measuring deflection and computing Young's Modulus. You should also compare and contrast at least 2 skin materials with regards to their performance and influence on product weight.

You will be required to create a digital slide presentation of your results for the president of the company.

Part 1. Create the beams
Using the materials provided by your teacher, create ample test beams to perform all prescribed configurations as outlined above.

Part 2. Conduct the testing and collect data
Test the beams as outlined in ECI lab 2-1 (Stressed-Skin Composites), pp. 2-9 through 2-17 of the student manual. Collect data in an organized manner.

Part 3. Analyze data
Perform computations of Young's Modulus and Modulus-to-weight ratio. Prepare data and results to be included in the presentation.

Part 4. Prepare presentation
Create a digital slide presentation of your investigation and results. Be sure to include a sample computation of Young's Modulus and Modulus-to-weight ratio.

Part 5. Submit your work
Convert your document to a PDF to prepare it for upload. Name the PDF as your MSIS number, last name, and first name (ex. 000123456 Smith John).