Areas of Development

• Topics suggested by material users and/or investigators
  – We welcome other suggestions
• Not all the topics have been funded; due to limited budget, some may not be funded
• NCAMP EGB & IAB will help select topics
  – more detailed proposals will be sent to designated EGB & IAB members
• These projects are designed to enhance the NCAMP material database
  – Experiments will use NCAMP materials
  – Focus on real NCAMP material user issues and applications
Guide to Laminate Allowable Generation

Ongoing

Rich Fields & Yeow Ng
Guide to Laminate Allowable Generation
(subject to change)

Objective:
• Provide guidance on how to generate laminate allowables using NCAMP data

With the help of volunteers/consultants:
• Document current and past approaches
  – How to regress over the three (hard, quasi, soft) laminates
  – How to handle different fasteners, clearance, etc.?
  – How to perform validations?
• Discuss the advantages and disadvantages of different approaches
• For material properties that are not provided by NCAMP, suggest what tests the material user could to perform
• Please let us know if you or someone you know has experience in this area and would assist in the writing/reviewing process.
Aging of Prepreg Research

Ongoing through collaboration with University of British Columbia, Toray Composites America, Avpro, and Ames Lab at Iowa State University
Acoustic Infrared Spectroscopy Study of Out-Life Aging
John McClelland and Roger Jones
Center for Nondestructive Evaluation and Ames Laboratory, Iowa State University
Aged prepregs were sent to participating members in dry ice.

<table>
<thead>
<tr>
<th>Freezer Storage Time &lt;10°F</th>
<th>Out Time at 70° ± 10°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 day</td>
<td>✓</td>
</tr>
<tr>
<td>3 days</td>
<td>✓</td>
</tr>
<tr>
<td>5 days</td>
<td>✓</td>
</tr>
<tr>
<td>7 days</td>
<td>✓</td>
</tr>
<tr>
<td>10 days</td>
<td>✓</td>
</tr>
<tr>
<td>12 days</td>
<td>✓</td>
</tr>
<tr>
<td>15 days</td>
<td>✓</td>
</tr>
<tr>
<td>18 days (Note 1)</td>
<td>✓</td>
</tr>
<tr>
<td>See Note 2</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Property</th>
<th>Method/ Condition</th>
<th># Replicates</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Beam Strength</td>
<td>ASTM D 2344-00, RTD</td>
<td>8</td>
<td>NCAMP</td>
</tr>
<tr>
<td>Gel Time</td>
<td>ASTM D3532-99</td>
<td>3</td>
<td>Toray</td>
</tr>
<tr>
<td>Tack</td>
<td>NCAMP Test Plan</td>
<td>3</td>
<td>NCAMP</td>
</tr>
<tr>
<td>Drape</td>
<td>NCAMP Test Plan</td>
<td>3</td>
<td>NCAMP</td>
</tr>
<tr>
<td>HPLC</td>
<td>SACMA SRM 20R-94</td>
<td>2</td>
<td>Toray</td>
</tr>
<tr>
<td>DSC</td>
<td>SACMA SRM 25R-94</td>
<td>2</td>
<td>Toray</td>
</tr>
<tr>
<td>Photomicrography and void content (and C-scan)</td>
<td>MIL-HDBK-17-1F, sec 6.6.7.3</td>
<td>As needed</td>
<td>NCAMP</td>
</tr>
<tr>
<td>Acoustic Infrared Spectrum</td>
<td>Ames Lab Procedures</td>
<td>As needed</td>
<td>Ames Lab</td>
</tr>
<tr>
<td>Tests related to process modeling</td>
<td>As needed</td>
<td>As needed</td>
<td>UBC</td>
</tr>
<tr>
<td>APA 2000 or similar tests</td>
<td>As needed</td>
<td>As needed</td>
<td>Avpro</td>
</tr>
</tbody>
</table>
A SUGGESTED TOPIC

Sandwich Cocure Effects

Principal Investigator: TBD
Sandwich Cocure Effects

(subject to change)

• How to go from lamina and laminate properties to sandwich properties (building block)?
  – Document common industry practices
  – Assumptions, validation approaches, etc.

• What factors to consider?
  – Autoclave pressure, face-sheet porosity, face-sheet dimpling, honeycomb cell size, material variability (coefficient of variation), core density, etc.

• Include sandwich cocure tests as part of NCAMP qualification program?

• Please let us know if you or someone you know has experience in this area and would assist in the writing/reviewing process.
A SUGGESTED TOPIC

Upper & lower processing envelope effects

Principal Investigator: TBD
Upper & Lower Processing
Envelope Effects (subject to change)

Objective:
• Validate MRCC and/or UBC’s process maps & contours through mechanical and other tests

Some issues to consider:
• What properties are most sensitive to upper and lower processing envelopes?
• What test methods are most useful in evaluating these properties
• How many specimens per test method? How bad is too bad? etc.
Upper & Lower Processing
Envelope Effects (subject to change)

Tasks:

• Develop a test plan which evaluates the upper and lower ends of the processing envelope
  - To ensure that allowables remain valid when processed within the envelope
  - Consider both fresh and aged prepregs

• Include upper & lower processing envelope tests in NCAMP qualification program?
A SUGGESTED TOPIC

Effects of Defects

Principal Investigator: TBD
Effects of Defects (subject to change)

Objective:

- Determine the effects of common material defects (usually due to processing) such as void/porosity
  - Limited to lamina and laminate levels only

Tasks:

- Define the types of material defects and their known or suspected effects
- Develop a test plan to determine the effects of such defects
- Include effects of defects tests in the NCAMP qualification program?