M&P Qualification and Control

Material Selection & Process Definition

- Select adhesives & substrate materials that are chemically compatible for adhesive bonding and meet application requirements
  - Environmental use limits (e.g., guideline for $T_{gwet}$)
- Establish detailed bonding procedures and process limits suitable for selected manufacturing approach
  - Surface preparation
  - Mix ratios
  - Cure cycle
  - Other factors affecting substrate surface wetting and chemical adhesion
M&P Qualification and Control

Qualification Testing

- Qualification tests to demonstrate the suitability and repeatability of selected materials & bonding processes
  - Repetitive testing of key properties – set requirements
    - Distinct batches of material
    - Distinct bonding process runs controlled by the specs
  - Testing details characteristic of the application
    - Chemical and physical tests
    - Mechanical tests (load types, environment)
    - Bond durability tests
    - Bond test specimen details (bondline thickness, overlap length)
  - Analysis & documentation of qualification data
    - Statistical data treatment
    - Apply qualification data to subsequent material & process control
• Specifications and instructions to control materials
  – Documented material requirements (acceptance limits)
  – Acceptance testing for adhesives
    ➢ Chemical, physical and mechanical test types
    ➢ Test details (adherend types, environmental effects)
  – Control of ancillary materials (e.g., peel ply)
  – Adhesive & substrate protection, storage and handling
    ➢ Shipping instructions, storage environment and out time
    ➢ Protection from contamination
    ➢ Pre-bond moisture of substrates and adhesives

• Adhesive material changes that require re-assessment
M&P Qualification and Control

Process Control

- Specifications & instructions to control bond processes
  - Bonding process details to be controlled and monitored
    - Substrate surface preparation for bonding
    - Adhesive mixing variables (if applicable)
    - Adhesive application (methods and timing)
    - Bondline thickness
    - Cure pressure and temperature
  - In-process bond testing (witness panels)
  - Inspection of bonded structure
    - Geometric tolerance assessments
    - Use of NDI

- Substrate material changes that require re-assessment
- Changes in bond processes that require re-assessment