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# Bonding Difficult to Bond to Surfaces with High Performance Tapes

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ASC Pressure Sensitive Adhesives Short Course

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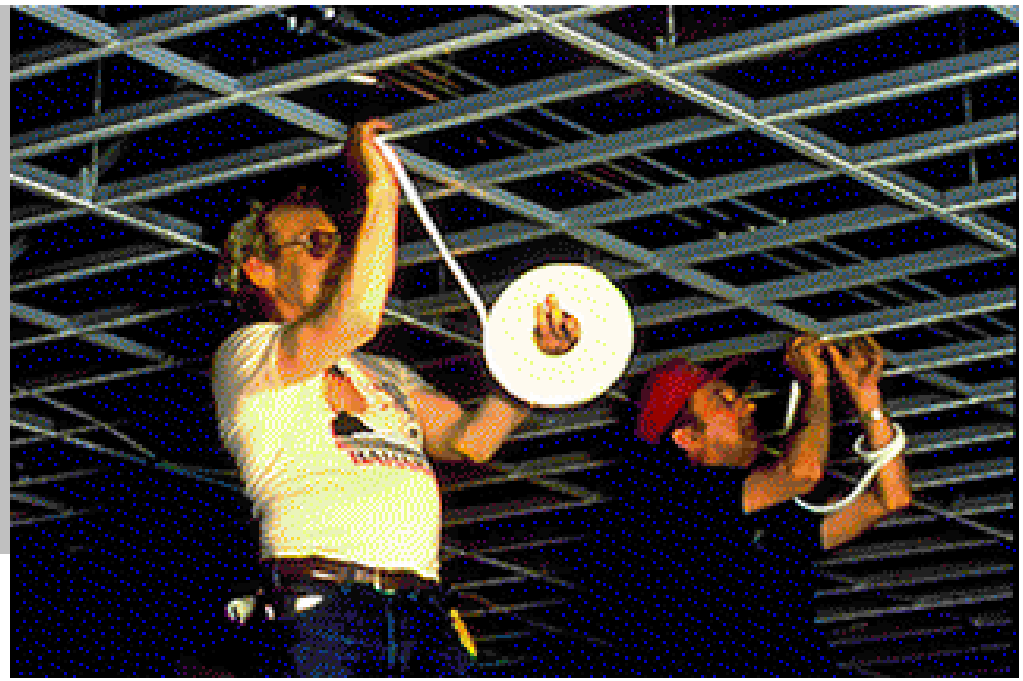

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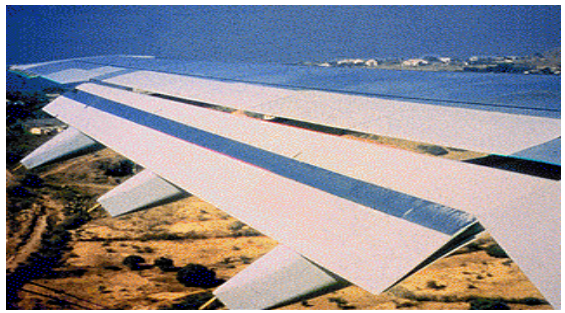
# Bonding Difficult to Bond to Surfaces with High Performance Tapes

- What are High Performance Bonding Tapes?
- Adhesion
- Surfaces
- Surface Modification
- Stresses and Design Tips

# High Performance Bonding Tapes

## Convenience of Tape, Strength to replace mechanical fasteners


**Truck Bodies**



**Airbus A-300 Scuff Strip**

**Architectural Metal**


**Traffic and Commercial Signs**

# What Makes High Performance Bonding Tapes Unique?

- **Acrylic Foam Technology**
- **Viscoelasticity**

  **ENERGY ABSORPTION**

  Absorb and dissipate energy by the acrylic foam core

  ➔ The foam provides the strength!

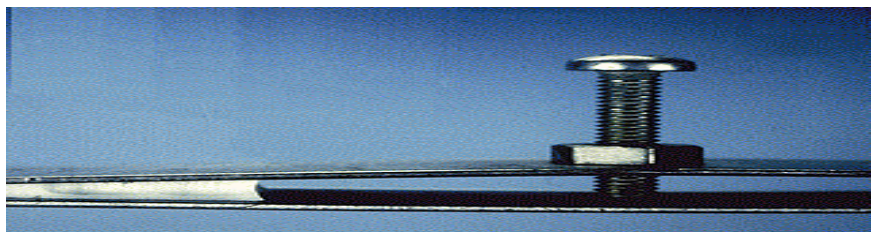
  **STRESS RELAXATION**

  Reduce long term stress in bond line by dispersing into the acrylic foam

  ➔ The foam protects the bond!

- **Durability**

  All-acrylic construction
  100% Closed Cell



# Features, Advantages Benefits of using High Performance Bonding Tapes

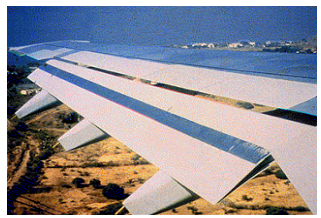
- Improved appearance
- Productivity



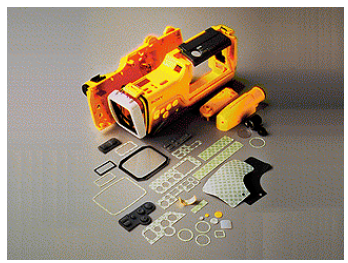
- Vibration & fatigue resistant

- Uniform stress distribution

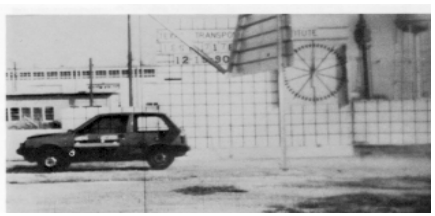
- Weight reduction



- Proven durability



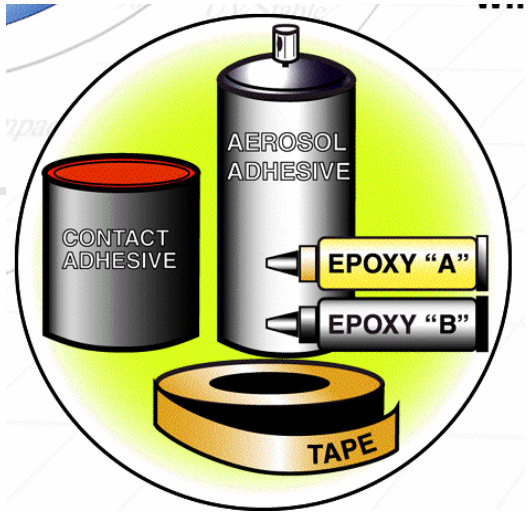
- Bonds dissimilar materials



- Seals and bonds

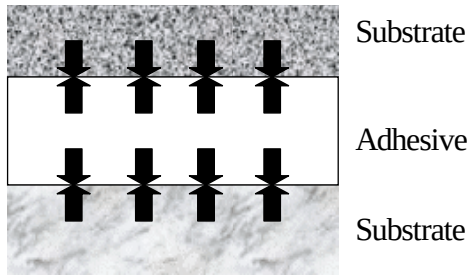

- Allows unique designs

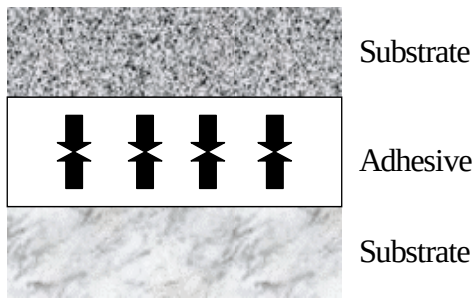
# Adhesives and Adhesion




An **adhesive** is a substance is capable of holding materials together by surface attachment.

- **Adhesion** – force between dissimilar materials.
- **Cohesion** - internal strength of the adhesive.




**Note:** With High Performance Bonding Tapes the **cohesion** is built into the tape. Achieving surface **adhesion** is **critical** to achieving total strength.

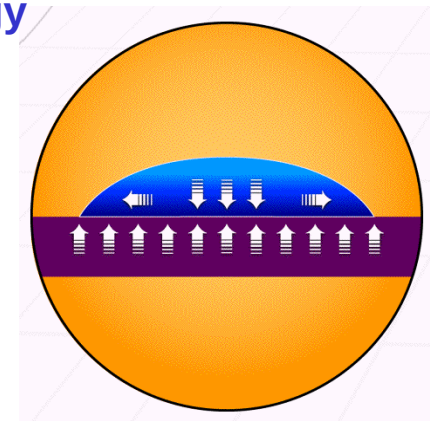
# Surfaces

- Surface Energy
- Glossy Surfaces
- Surface Roughness
- Weak Boundary Layers

# Surface Energy

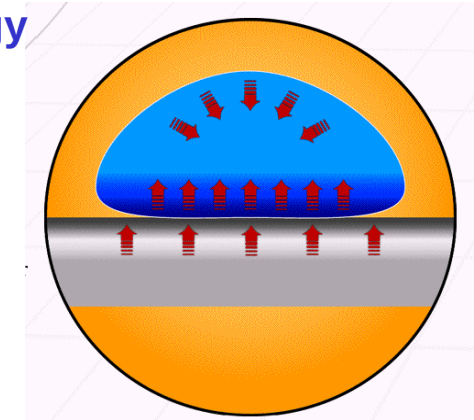
**High Surface Energy**

Metals
Polyimide
Polyester
Acrylic
Rigid Polyurethane
ABS
Polycarbonate
PVC (rigid)



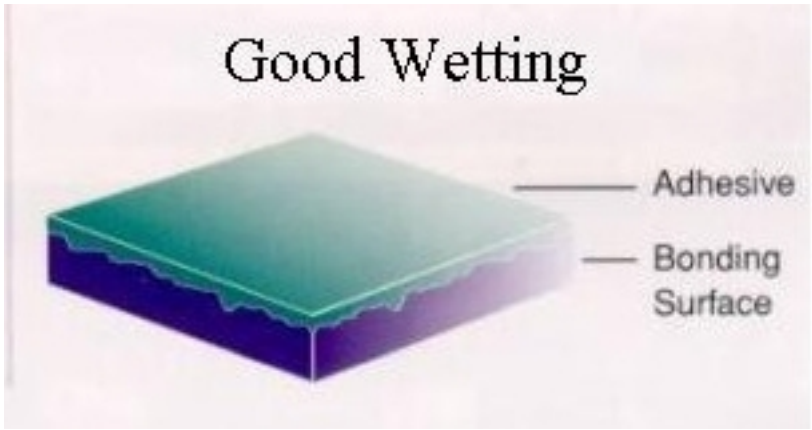
**Low Surface Energy**

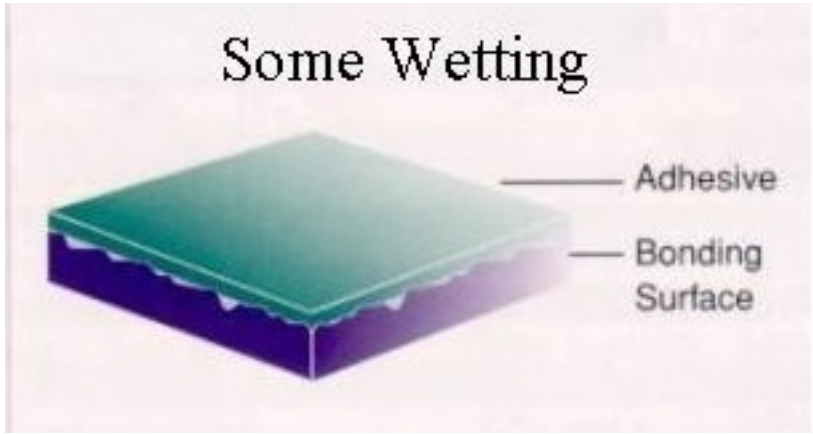
Polystyrene
Acetal
EVA
Polyurethane elastomer
Polyethylene
Polypropylene
PVF
PTFE
EPDM (Prime)

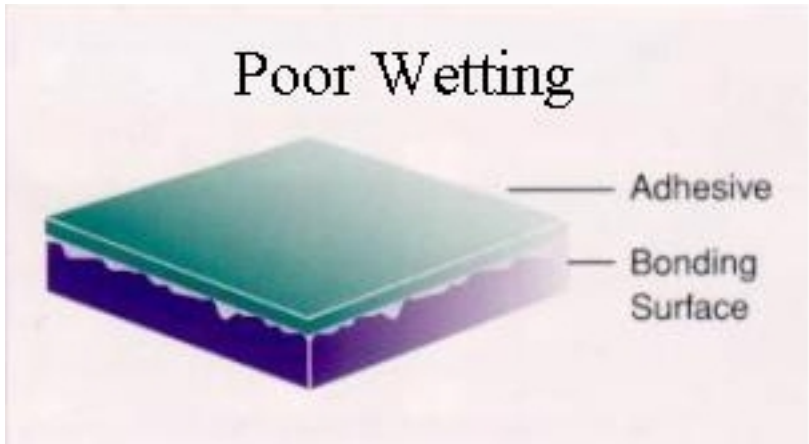


- Affects how the adhesive wets out the surface
- Most common for adhesion to be directly dependent on surface energy
- Important: Use the right tape for the surfaces involved.

# Adhesive Wetting



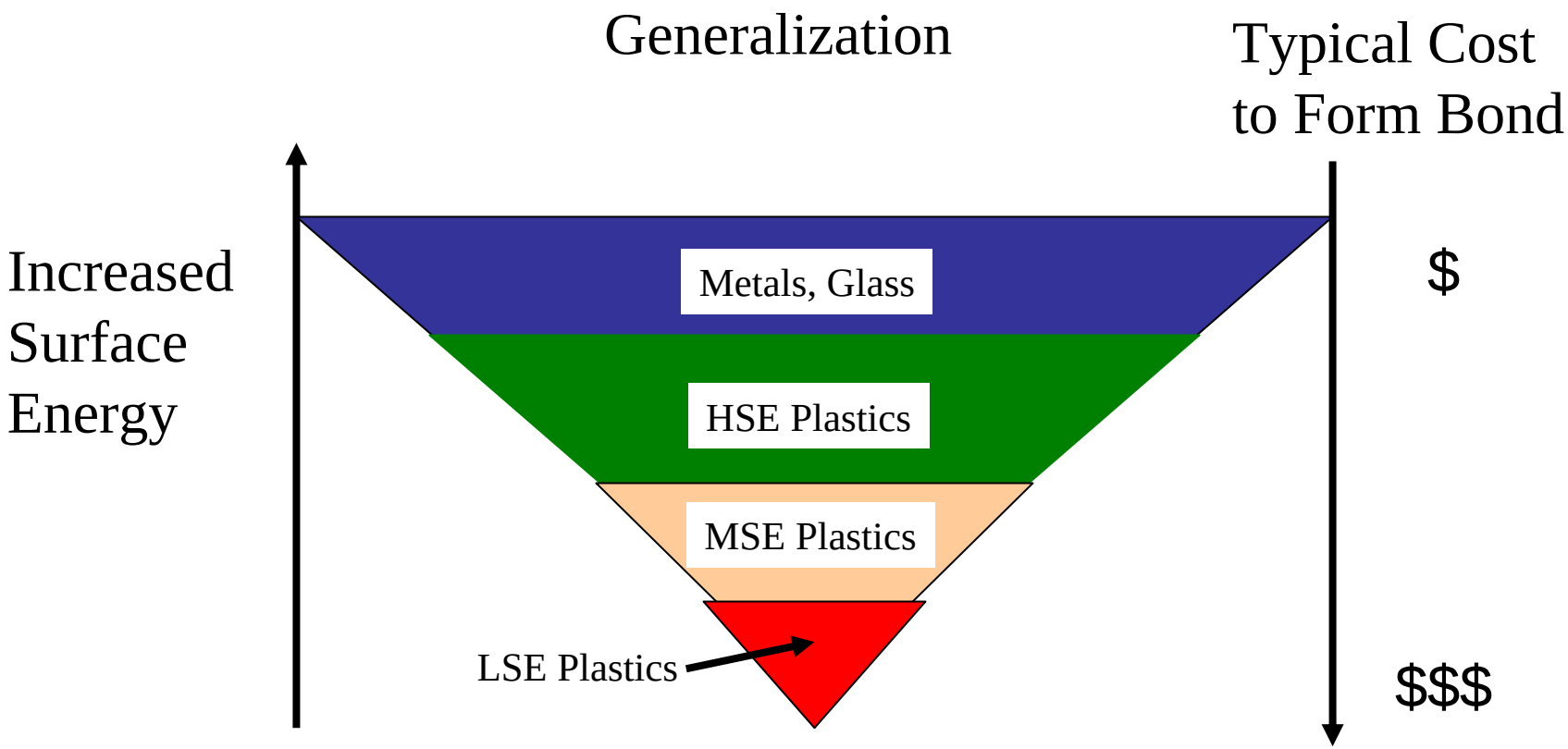



# Surface Energy Of Substrates

- VHSE Substrates (>200 dynes/cm)
  - Metals, Glass
- HSE Plastics (> 37 dynes/cm)
  - Kapton, Nylon, polyester, epoxy paint, ABS, polycarbonate, rigid PVC, acrylic
- MSE Plastics (31-36 dynes/cm)
  - PVA, polystyrene
- LSE Plastics (< 31 dynes/cm)
  - Polyethylene, polypropylene, Teflon

# Surface Energy



# Rough Surfaces

- Abrade to make smoother
- Use thicker bondline (also good for varying bond gaps)
- Use softer tape (ie. foam tape vs solid adhesive) or lower viscosity adhesives.
- Avoid air entrapment in the bond line

# Glossy Surfaces

- Glossy is good for wetting if adhesive is lower surface energy than substrate
- Light abrasion to increase contact area
- Surface energy is largest factor

# Weak Boundary Layers

- Chemical additives that bloom to the surface
  - Clean with solvent
  - Abrade off the surface/clean
- Surface oxidation (e.g. rust)
  - Abrade off the surface/clean

# Surface Modification - **CAP**

- **C**leaning
- **A**brading
- **P**riming

# Cleaning

- Make sure surface is clean from dirt and oils.
- Clean with a solvent or grease cutter.

# Abrading

- Usually a light abrasion works well.
- Creates more surface area.
- Creates higher surface energy.

# Priming

- Primer application
  - Primer classes
  - Application methods
  - Pre-abrasion helps

# Other Surface Modification

- Flame Treatment
- Flame treatment with primer

  *be careful, this can be dangerous

# Tactics for Low Surface Energy Materials

- Cleaning
- Abrasion
- Priming/Surface modification
- Novel adhesive chemistry

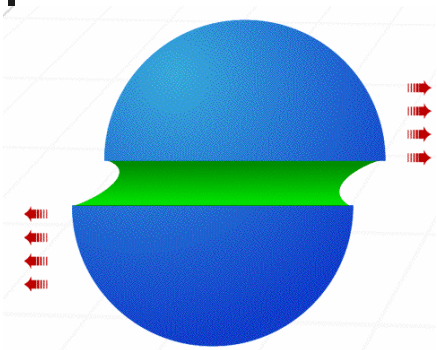
# Novel Adhesive Chemistry

- Acrylic Adhesives designed to “bite into” polyolefins - acrylates

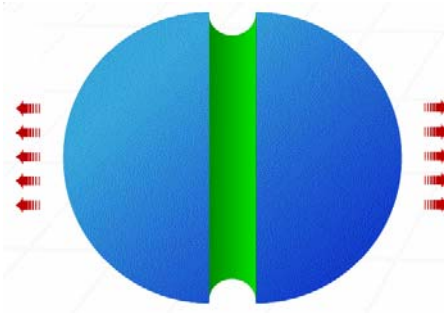
# Bond Joint Design

- No matter your tactic, good bond design is the foundation to a strong joint
- Examples of bond stresses:

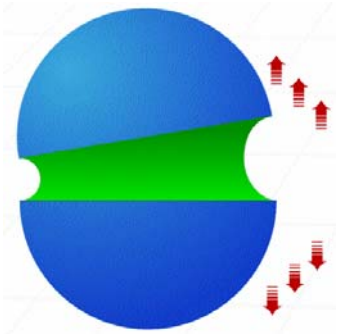
# Stress Modes that can act against a Bonded Joint



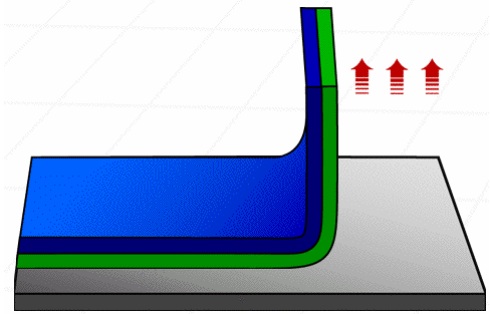
**Shear**



**Tensile**



**Cleavage**



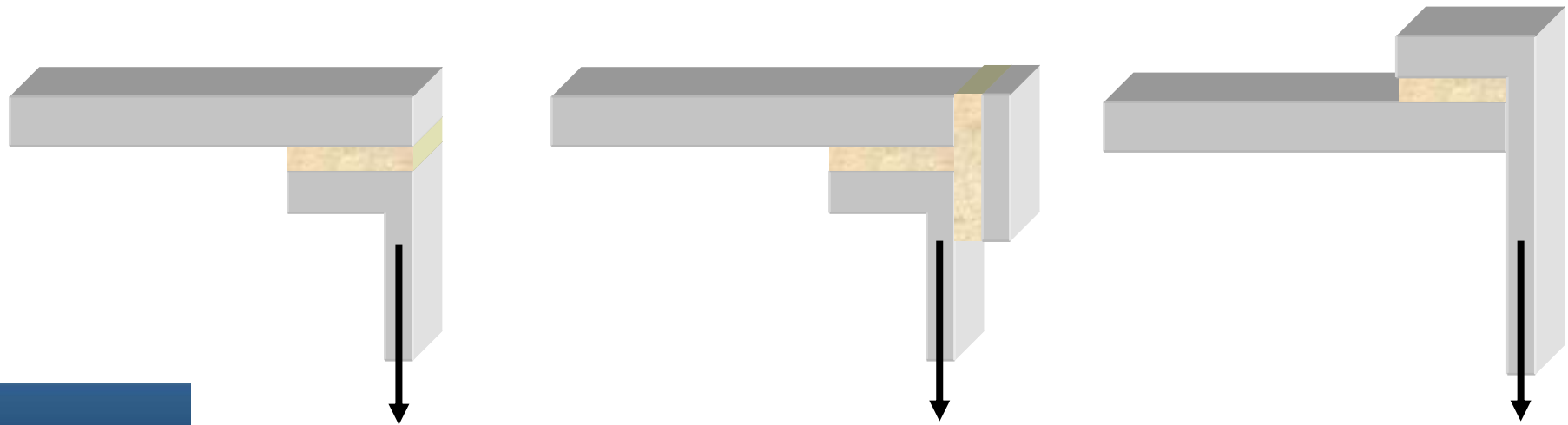
**Peel**

- **Better for Design**
- **More problems for Design**

# Joint Design

- Designing the joint to minimize peel or cleavage stresses on the bond line and maximize tensile, shear or compressive stresses is desirable

Improving joint design to accommodate applied stress



# Summary

- A good joint design and use of bonding methods for LSE materials increases productivity, design flexibility and can eliminate need for mechanical fastening.
- When in doubt, use the C. A. P. methods.

# For more information…

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