Non-Arc Welding Processes

- Resistive heating, chemical reactions, focused light and electrons, sound waves, and friction can also be used to join materials
  - Resistance welding
  - Oxy-Fuel Welding
  - Friction welding (&Solid State)
  - Laser and electron beam welding
  - Brazing and soldering
  - Plastics joining
  - Adhesive bonding

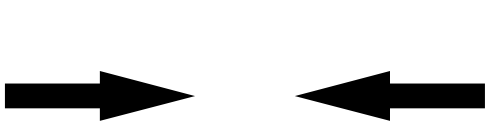
Adhesives

- Thermosets form long polymer chains by chemical reaction (curing)
  - Heat is the most common means of curing
  - Ultraviolet light, oxygen - acrylics
  - Moisture - cyanoacrylates
- Thermoplastics (hotmelts)
  - Adhesive is heated until it softens, then hardens on cooling -Polyethylene, PVC

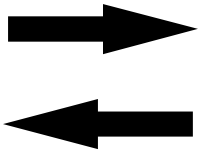
Curing of Adhesives

- Thermosets form long polymer chains by chemical reaction (curing)
  - Heat (epoxy)
  - Ultraviolet light, oxygen (acrylics)
  - Moisture (superglue)

Stress Modes - Best to Worst

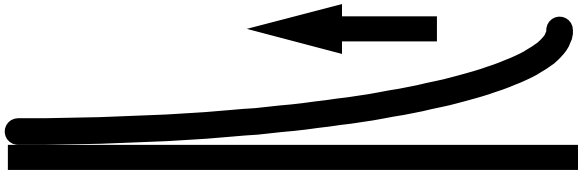


1. Compression

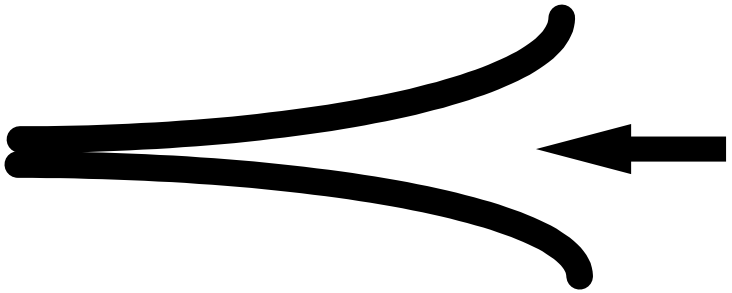


2. Shear

3. Tension



4. Peel



5. Cleavage

Why Adhesive Bonding?

- Dissimilar materials
  - Plastic to metal
- Materials that can be damaged by mechanical attachments
- Shock absorption or mechanical dampening
- Laminate structures
  - Skin to honeycomb structure

Adhesive Selection

- Adhesive selection is based primarily on
  - Type of substrate
  - Strength requirements, type of loading, impact requirements
  - Temperature resistance, if required
- Epoxy
- Cyanoacrylates
- Anaerobics - metals
- Urethanes
- Silicones
- Pressure sensitive adhesives (PSAs)

Advantages

- Joining dissimilar materials - plastic to metal
- Materials that can be damaged by mechanical attachments
- Blind joints
- Shock absorption or mechanical dampening
- Temporary alignment
- Laminated structures
- Thin substrates - skin-to-honeycomb construction
- Stress distribution

Limitations

- Adhesives don't *do* work, they *distribute* work; they are not structural materials
- Environmental degradation
  - Temperature
  - Oxidation
- Difficult to repair
- Curing or setting time
- Surface preparation