

Adhesive Technology for Bonding Plastics

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Using Adhesives

Advantages

- Join dissimilar materials
- Versatile
- Optimized for product requirements
- Can be easy to use
- Can combine with other processes

Disadvantages

- Slower cycle times
- Cost
- Cleaning, fixturing & setup issues
- Some substrates not appropriate
- Stress cracking issues

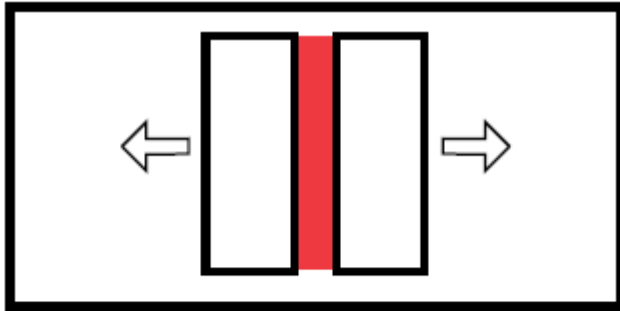
Adhesive Usages

- Structural
 - Bonding load bearing parts of a product
- Non-Structural
 - Bonding materials for insulation, cushioning and paneling.

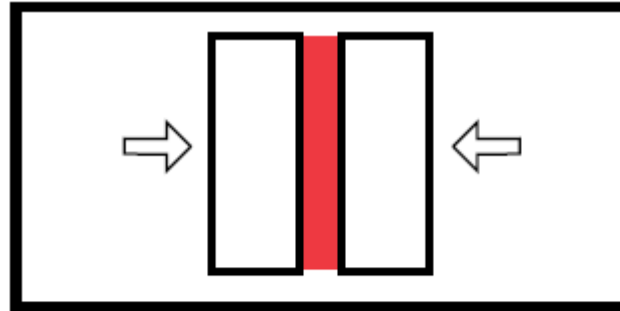
Measurements / Tests / Specifications

- Tensile Strength (ASTM D638)
- Compressive Strength (ASTM D695)
- Shear Strength (ASTM D1002)
- Cleavage Strength – block (ASTM D4501)
- Peel Strength (ASTM D3330)
- % Elongation (ASTM D638)
- Viscosity
- Open Time / Pot Life
- Temperature resistance
- Hardness (ASTM D785)
- Thermal Expansion (ASTM D696)
- Water Absorption (ASTM D570)

Stress Types



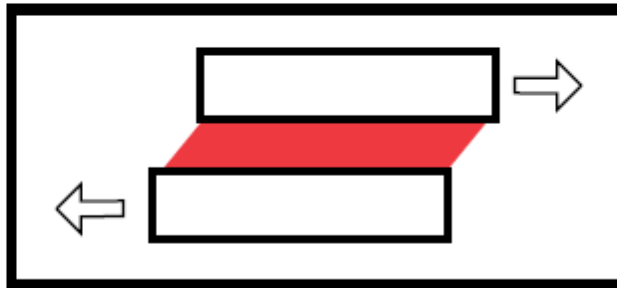
TENSILE
FAIR



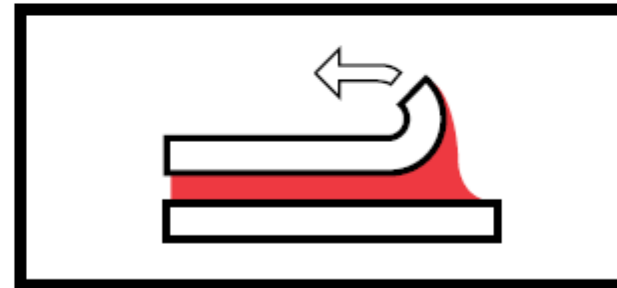
COMPRESSIVE
GOOD



CLEAVAGE
POOR



SHEAR
GOOD



PEEL
POOR

Product Design

- Materials – Substrates
- Product Shape
- Joint Types

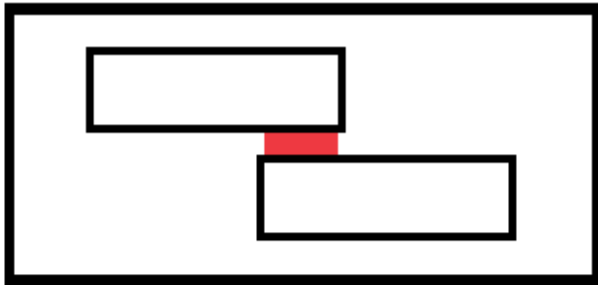
Substrate Materials

- Polyoliphins – try something else
- Plastic – Metal mixes
- ABS, polycarbonate, PPO, polystyrene
- Laminates
- Thermal / Pressure form

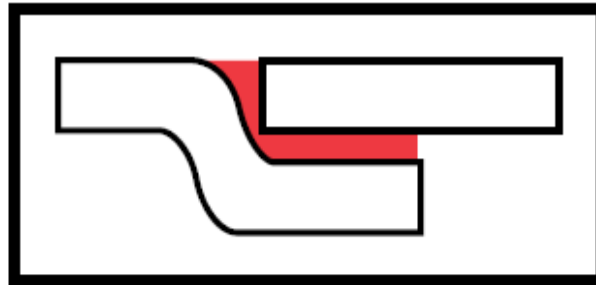
Part Shape

- Complexity of design
- Stress points & type
- Surface texture
- Fixturing issues

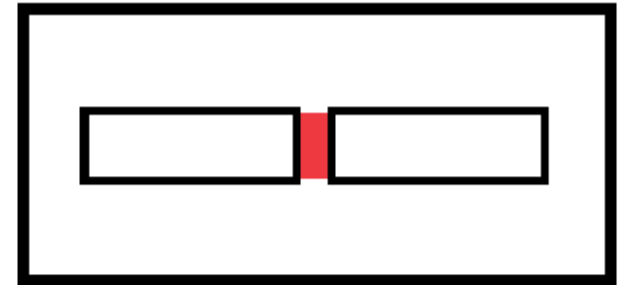
Joint Types



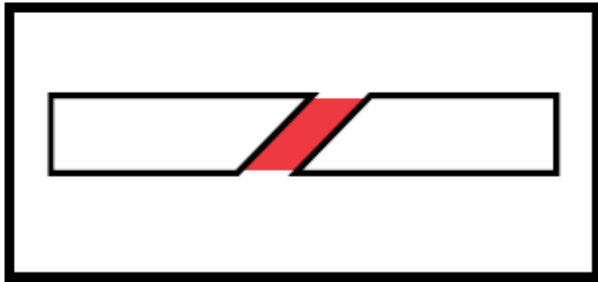
LAP/OVERLAP
GOOD



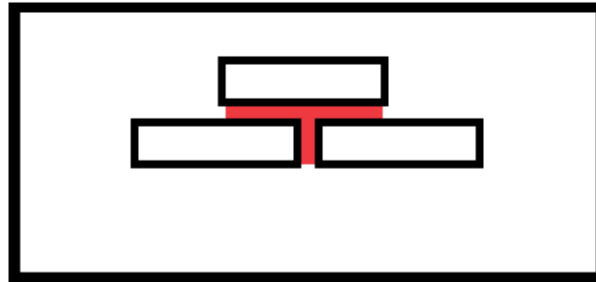
JOGGLE LAP
GOOD



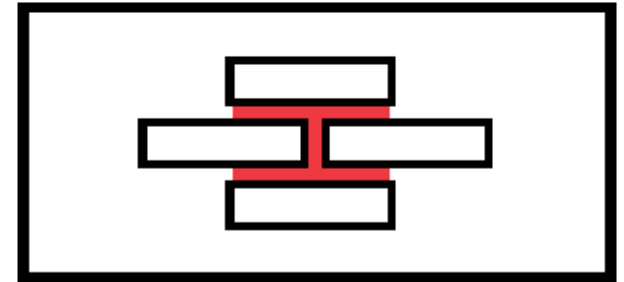
BUTT
FAIR/POOR



SCARF
FAIR



SINGLE STRAP
GOOD



DOUBLE STRAP
BEST

Part Cleaning

- Solvent Wipe
- Alkaline Cleaning
- Ultrasonic Cleaning
- Flame Spray Treatment
- Corona Discharge
- Plasma Treatment
- Thermal Treatment
- UV Exposure
- Primers
- Abrasion
- Etching
- Iodine / Other Treatments

Adhesive Types

- Two Components
 - Epoxies
 - Urethanes
- UV Cure
- Anaerobic
 - Cyanoacrylate
 - Acrylics
- Tapes
- Hot Melts
- Adhesive Films
- Contact cements

Adhesive Types

PERFORMANCE CONSIDERATIONS	ADHESIVE CATEGORY							
	Cyanoacrylates	Epoxies	Hot Melts	Light Cure	Silicones	Urethanes	2-Part Acrylics	2-Step Acrylics
Benefits	Excellent adhesion to rubber or plastics	Wide range of formulations	Fast, large gap filling	Rapid cure/adhesion to plastics	Excellent temperature resistance	Excellent toughness/flexibility	Good impact resistance/flexibility	Good impact resistance/flexibility
Limitations	Low solvent resistance	Mixing required	Low heat resistance	Light Cure System required	Low strength	Sensitive to moisture	Mixing required	Primer required
Temperature Resistance Typical for the category (°F) Highest Rated Product (°F)	-65 to +180 +250	-65 to +180 +275	-65 to +250 +330	-65 to +300 +350	-65 to +400 +600	-65 to +250 +300	-65 to +250 +250	-65 to +300 +400
Environmental Resistance Polar Solvents (ex. H ₂ O, Ethylene Glycol, IPA, Acetone) Non-Polar Solvents (ex. Motor Oil, Toluene, Gasoline, ATF)	Poor ¹ Good	Very good Excellent	Good Good	Good Very good	Good Poor	Good Good	Good Very good	Good Very good
Adhesion to Substrates Metals Plastics ² Glass Rubber Wood	Very good Excellent Poor Very good Good	Excellent Fair Excellent Fair Very Good	Good Very good Good Fair Excellent	Good Excellent Excellent Fair Poor	Good Fair Very good Good Fair	Good Very good Good Good Fair	Excellent Excellent Good Poor Good	Excellent Fair Excellent Poor Good
Overlapping Shear Strength	High	High	Low	High	Low	Medium	High	High
Peel Strength	Low	Medium	Medium	Medium	Medium	Medium	High	Medium
Tensile Strength	High	High	Low	High	Low	Medium	High	High
Elongation/Flexibility	Low	Low	High	Medium	Very High	High	High	Medium
Hardness	Rigid	Rigid	Semi-soft	Semi-rigid	Soft	Soft	Semi-rigid	Semi-rigid

Adhesive Types

PROCESS CONSIDERATIONS	ADHESIVE CATEGORY							
	Cyanoacrylates	Epoxies	Hot Melts	Light Cure	Silicones	Urethanes	2-Part Acrylics	2-Step Acrylics
Number of Components	1	2	1	1	1	2	2	2
Cure Temperature	Room Temp.	Room Temp.	Room Temp. ²	UV/Visible	Room Temp.	Room Temp.	Room Temp.	Room Temp.
Fixture Time Average Fastest	60 seconds 10 seconds	35 minutes 3-5 minutes	70 seconds 20 seconds	30 seconds 5 seconds	25 minutes 10 minutes	25 minutes 5 minutes	20 minutes 3-5 minutes	5 minutes 30 seconds
Full Cure Time	24 hours	12 - 24 hours	1 hour (or when cooled) ⁴	30 - 60 seconds	24 hours	24 hours	24 hours	24 hours
Gap Fill Ideal (in inches) Maximum (in inches)	0.001 - 0.003 0.010	0.004 - 0.006 0.125	0.002 - 0.005 0.240	.002 to .010 0.25	0.004 - 0.006 0.240	0.004 - 0.006 0.125	0.010 - 0.040 0.5	0.002 - 0.004 0.040
Dispensing/Mixing Equipment Required?	No	Yes	Yes	No	No	Yes	Yes	Yes
Light Cure Versions Available?	Yes	Yes	No	Yes	Yes	No	No	Yes
For more information on each adhesive category, refer to pages...	12-15, 29, 30, 59, 61	16-19, 21, 59, 61	24-27	28-31, 58-60	29, 31, 59, 61	17, 20, 21, 59, 61	9, 11	8, 10

Tapes / Films

- Simple
- Can fill space
- Uniform Thickness
- Eliminates stress cracking

Hot Melts

- All types of materials
- Thermal setting capabilities
- Can be fast

References

- Loctite Design Guide for Bonding Plastics
- Loctite Surface Cleaning Guide
- Loctite Do It Right Guide
- Assembly Products Guide
- 3M Adhesive Joining Guide
- 3M's Site http://www.3m.com/us/mfg_industrial/plastics/
- Loctite Site
http://loctite.com/int_henkel/loctite_us/index.cfm?pageid=10&layout=1

Thank You