Outline

• Substrate Preparation
• Adhesive Selection, Handling and Application
• Prebake and Molding
• Troubleshooting Bond Failures
• Industry Trends
Substrate Types and Preparation Guidelines

• Various grades of steel and aluminum, others include urethane, rubber and engineered plastics

• Best practice steps:
  – **Degreasing** removes cutting/machining oils, greases, dirt, etc. prior to abrasion step
  – **Abrasion** (blasting, grinding, sanding) removes surface oxidation and increases surface area for primer or adhesive wetting
  – **Final degreasing** removes any carryover residuals from abrasion, a “clean” air blow-off can be substituted
  – Exceptions are pre-treated metals such as zinc plating or zinc phosphate
Blast Media Types

• **Grit: angular shape “cuts”**:  
  – G25 - 80 grit media is typical  
  – Good anchor profile, 1-3 mils (25-75 microns) is ideal

• **Shot: round shape “peens”**:  
  – Less surface area, potential for embedded contamination  
  – Typical for rough surfaces like cast iron
Substrate Preparation Precautions

• Match degreaser to type of oil, typically solvent base (MEK, xylene, etc.) or alkaline cleaner

• For stainless steel substrate, use aluminum oxide only, steel media can cause under-bond corrosion

• Avoid excessive lathe grooving, adhesive puddles in bottom of the V, poor adhesion or failure

• Inspect blast media periodically, worn down or contaminated media, poor adhesion or failure

• Once prepared, apply primer or adhesive ASAP (target <2 hours), avoids formation of a weak oxide layer
Adhesive Types and Selection

• **One coat:** *Chemlok®* 218, 213 or 8600 (aqueous):
  – Designed to bond in one step, majority of use
  – Products vary by composition, viscosity and color

• **Two coat:** *Chemlok 219/218, 219/213 or 219/8600:*
  – Primer may improve adhesion for hard-to-bond substrates
  – Improve environmentals (temperature and chemical resistance)
  – 219, 218 and 8600 can be pigmented, <1 gram/gallon

• Others for TPU and Millable Gum

• Testing will determine best product with your specific materials and processes
Handling and Mixing Guidelines

• Always use fresh product, FIFO practices
• Adhere to shelf life/associated storage conditions
• Use proper dilution solvent and amount, mix during addition of dilution solvent to avoid “shock”, never add product to dilution solvent
• Seal cans when not in use to reduce solvent evaporation and minimize contamination
• Store in approved safety cabinets/areas when not in use
Application Techniques

• Applied by brush, spray, roll or dip, since most are manual process, consistent operator technique is key

• Brushing is popular, use clean, dedicated, properly sized brush

• Avoid thick and thin areas, puddles, tears and bare spots, poor adhesion or failure

• If application produces brush marks or globs, use 2 thin coat applications, with drying between coats:
  – 3 to 4 parts product to 1 part dilution solvent by volume
Dry Film Thickness Guidelines

• One coat: Adhesive at 0.75 - 1.25 mils
• Two coat: Primer at 0.2 - 0.4 mils plus adhesive at 0.6 - 0.8 mils = same target as one coat
• Recent work shows 0.3 mils of adhesive over primer shows increased performance under load/250°F (121°C)+
• 1 mil target = 0.001” or 25.4 microns
• Measurement options: digital dry film gauge or 1-2 mil shim with a micrometer
• Common method is color contrast w/witness panel
Chemlok 213 Dry Film Thickness

0.5 mil  1.0 mil  <0.5 mils
Dry Film Thickness Precautions

- Caution with aggressive profile on substrate, measurements may be scattered, use a non-abraded substrate as a guideline

- **Too thin (<0.2 mils):** Lack of active adhesive ingredients to provide bond

- **Too thick (+2 mils):** Shearing (cohesive) within adhesive layer

- Optimal dry film thickness is determined with testing of your specific materials and processes
Drying, Handling and Storage of Coated Parts

• Dry 30 - 60 minutes at room temperature between coats (don’t place coated parts in oven immediately after application, blistering may result)
• Minimize handling coated areas, bare hand or dirty gloves, poor adhesion or failure
• For coated parts layover, tote in containers or cover to minimize airborne contamination
• Suggest coated parts be bonded within several shifts, typical maximum 30 day layover
Coated Part Prebake Guidelines

- Prebake coated parts of a minimum of 2 hours at ~250°F, maximum of 325°F, then load to mold
- Prebake allows product to lock into substrate, improves environmental performance of adhesives
- Prebake allows an equilibrium between all materials when substrate and polyurethane come in contact
- Several prebake cycles (cool-down to RT) still allow good bond
- Convection type oven (natural gas or electric) for uniform heat distribution, avoid hot/cold spots
Mold Release, Post Painting and Bond Check

• Caution with silicone containing agents, specifically edges where mold and coated substrate meet

• Follow supplier’s instructions for specific casting and post bake parameters

• Post painting or additional fabrication, caution due excessive temperature

• To test process steps, complete adhesion test if possible:
  – Screw-driver/pliers check along the edge
  – Push-off or peel test with machines
  – Create a taped area to provide a starting tab
Failure Modes Per ASTM International D429

R = Rubber retention
CP = Cement-to-Primer

RC = Rubber-to-Cement
COH = Cohesive
CM = Cement-to-Metal
Cement-to-Metal Mode

- Designated as CM, cement = primer or adhesive
- Primer or adhesive failure at the metal or substrate interface
- Bare substrate with primer or adhesive transferred to polyurethane surface
- Poor anchor profile, blast residue, contamination, oxidation

2 Coat System
- Rubber/Polyurethane
- Adhesive
- Primer
- Metal/Substrate

1 Coat System
- Rubber/Polyurethane
- Adhesive
- Metal/Substrate
Rubber-to-Cement Mode

- Designated as RC, cement = adhesive
- Failure occurs between polyurethane and adhesive
- Look for evidence of adhesive adhering to substrate, but not to polyurethane surface
- Thickness, contaminated surface, prebake cycle

![Diagram showing 2 Coat and 1 Coat Systems](image)
Industry Trends

• OTC (New England states) restricts primer limit to **250 grams/liter**, plus Houston, Dallas and Phoenix metro

• Check your State and Federal regulations for primer and adhesive emissions compliance:
  – Install control equipment
  – Outsourcing, i.e. Custom Coater
  – 219/8600 aqueous “Hybrid” system, lower VOC/HAP option

• Global supply of substrates: caution on rust preventatives applied for shipment

• Inquiries for higher temperature resistance for wheels and rollers

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