

Coating and Curing System Cleaning

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History with Toxic Use Reduction

Draw die cleaning:

- ShipShape deemed hazardous and removed
- Isopropanol ultrasonic unit removed

2013

Coloring die cleaning:

- WPI students' alternative solvents study suggested alternatives to acetone

2016

Coloring die cleaning:

- Volume of acetone and isopropanol used reduced by half
- Solvent in ultrasonic bath replaced with SF-50

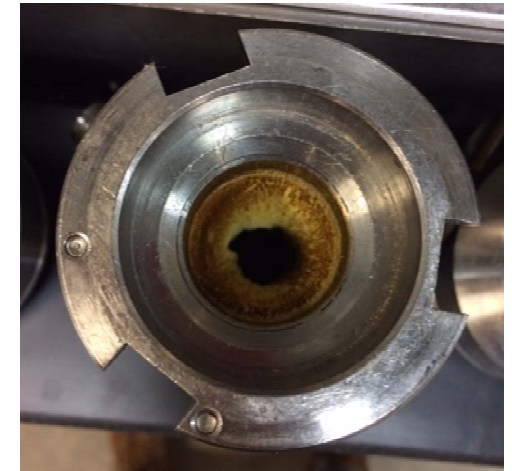
2015

Draw die cleaning project launch with TURI cleaning lab support

2017

New Changes

- Implementation of new product changed demands on supporting processes, including cleaning parts.
 - More soil on the same system
- Potassium hydroxide (KOH)
 - Safety risk
 - Process update needed for 24/7 operation
- Acetone
 - Existing cleaning unit unreliable
 - Changes increased demands on unit



Die Cleaning Requirements

- Turnaround time and capacity
 - Equivalent to current system or better
 - 2 dies clean in about 25 minutes
- Footprint
 - Must fit in existing room
 - Need to have a backup system in case of failure
- Maintenance
 - Easily maintained and repaired
- Cleaning solution
 - Should not cost more than current acetone consumption

Die Cleaning Challenges

- Cleaning cycle time and space required
 - Not much excess room to have test materials at point of use
- Coating properties
 - Viscosity
 - Potential partial cure
- Realistic production testing
 - Promising cleaners did not perform as well on production parts as in initial testing
 - Complex geometry of part

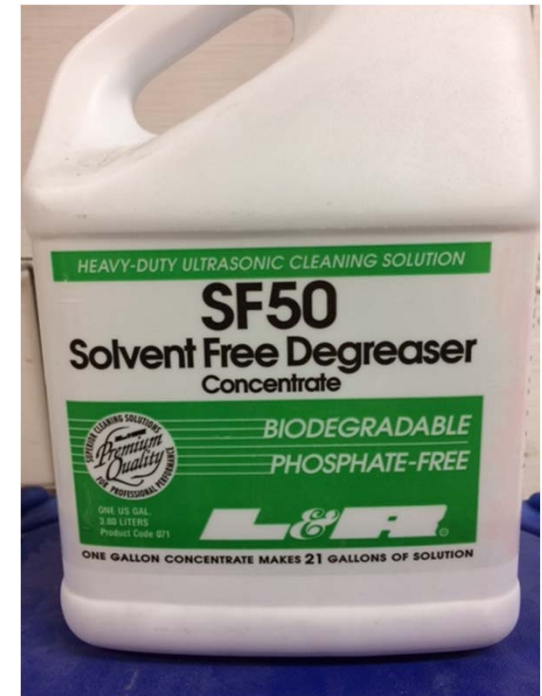


Stakeholders

- Production
 - Draw
 - Quality control
- Chemical technicians and Engineering
 - Maintaining and repairing equipment
 - Storage, use, and disposal of chemicals
- Safety

Finding Alternatives

- Cure unit part cleaning:
 - Replacement cleaner (SF-50) is safe to handle
 - SF-50 already stocked and used
 - Splash risk of KOH bath eliminated
 - Cleaning cycle time fast
 - Enables stock of spare parts
 - Some small equipment changes needed
 - Testing needed to verify that the system was not affected



Finding Alternatives Cont.

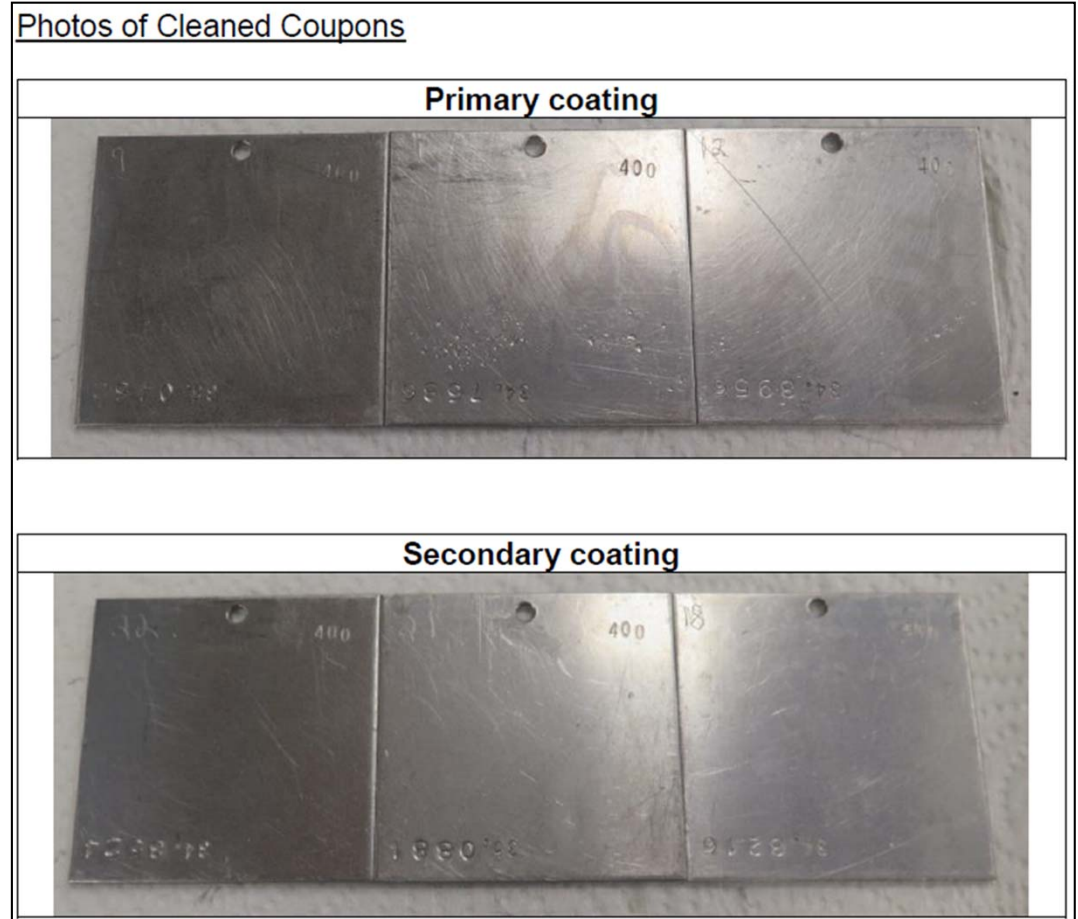
- Die block cleaning:
 - Non-flammable replacement solution would be safer
 - Preliminary testing from WPI project
 - TURI cleaning lab testing to minimize production disruption
 - Potential to negatively affect product
 - Potentially more complex or time consuming process



TURI Cleaning Lab Tests

Cleaning process variables:

- Cleaning solution concentration
- Time
- Temperature
- Ultrasonic agitation



Next Steps



- More lab testing with cleaners targeted for uncured viscous materials
- Researching and testing alternative cleaning systems
 - Our die cleaner will need to be replaced
 - We provided the lab with a spare part for more realistic testing and screening

Other Examples of TUR



- HF reduction project
 - Current project to minimize amount of hydrofluoric acid used in etching process
 - Funding provided by a TURI grant
- Waste chemical reduction
 - Opportunities to optimize chemical usage to minimize waste

Thank you!



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