Modified Alcohol: A Vacuum Degreasing Process
Session Topics

- Cleaning Basics
- What is Modified Alcohol
- Metalnox M6386
- Equipment / Process
- Sustainable Future
Cleaning Basics

IN TODAY’S MANUFACTURING WORLD
MOST ITEMS ARE CLEANED!
(Several Times in Some Cases)

✓ Critical Performance
✓ Reliability
✓ Process Requirements
✓ Personnel Safety

“Soils/contaminants/etc. must be removed!”
Increased demands for **QUALITY & RELIABILITY** calls for continuous improvements in many manufacturing processes, including *cleaning*.

Your end product must meet all applied specifications in a manner that assures success of operations.

Cleaning methods **must meet EH&S** concerns as well as “get the job done!”
Cleaning Basics

Basic Process Requirements

• Cleaning Performance

• Compatibility With Substrates

• Process Efficiency/Environmental Impact

• Worker Safety (EH&S)
Cleaning Basics

SYNERGY!
Application Areas

**Precision Cleaning**
- Mechanical parts
- Aircraft
- Automotive
- Watch
- Jewelry, Etc.

**Medical Industry**
- Implants
- Surgical Tools
- Cannula, Etc.

**Precision Optics**
- Lenses
- Mirror
- Prisms
- Masks, Etc.

**Coating Industry**
- Carbide Tools
- Automotive Parts
- Fixtures
Critical Cleaning
Automotive
Aerospace

Bringing Cleaning to Machining
Precision Optics, Glass, & PV

Optical lenses, eyewear, glass, plastic parts.

Electronic and industrial plastics & glass products.

Photo Voltaic Cells & Wafers

Soils range from fingerprints to pitch.
Move to Environmentally Green Cleaning Processes for Complex/Challenging Parts

- Move away from Legacy Halogenated Solvents such as *PERC, TCE, MC,* and *nPB* (EH&S Issues)

- Move away from Water-based Process due to consumption, discharge, energy, residues, and cost of operations.

- Move toward Closed Solvent Systems
Key Benefits of Closed Solvent Systems

- Ultra-Low VOC emissions
- Very Low chemical consumption
- Concentration of soil – low waste stream
  - Not throwing away cleaning chemistry
- Very Low odor
- Low worker exposure (Safety Plus)
- Low corrosion potential
- Ability to pull a vacuum to enhance drying / reduce carry-out
- Compact foot print (wash/rinse/dry @ one system)
• The fact that today’s cleanliness specifications for precision and critical cleaning cannot have any contaminant residue or rinse water residue on the end product, drives some users toward solvent.

• Use of solvent in manufacturing is GROWING due to inability of water to perform in certain criteria, component spacing, and restrictive drying process.

• Materials compatibility is a major area for concern where solvent is superior!  
  (Example: Multiple metals and lubes)
Removal of chips / oils / coolants

Various Applications
Challenging Parts
Challenging Parts
Challenging Parts – The Goal

Challenging Parts to Clean and Dry Parts

6 to 12 Minutes Typical
### Cleaning Chemistry Options

<table>
<thead>
<tr>
<th>Substance/Substance class</th>
<th>Hydrocarbons</th>
<th>Chlorinated Hydrocarbons</th>
<th>Modified alcohols</th>
<th>Aqueous cleaners</th>
</tr>
</thead>
<tbody>
<tr>
<td>C9-C13 Isoparaffins</td>
<td></td>
<td>Trichloroethylene</td>
<td>Modified alcohols</td>
<td>Alkaline cleaner</td>
</tr>
<tr>
<td>Polarity</td>
<td>Non – polar</td>
<td>Non-polar</td>
<td>slightly polar</td>
<td>polar</td>
</tr>
<tr>
<td>Organic contaminations (non polar) e.g. oil, fat</td>
<td>very good</td>
<td>very good</td>
<td>good</td>
<td>moderate</td>
</tr>
<tr>
<td>Organic, (polar) e.g. “combination contamination”</td>
<td>moderate</td>
<td>moderate - good</td>
<td>very good</td>
<td>moderate</td>
</tr>
<tr>
<td>Inorganic, (polar) contamination (Salts)</td>
<td>moderate</td>
<td>moderate</td>
<td>moderate - good</td>
<td>very good</td>
</tr>
<tr>
<td>Solid contamination (e.g. chips, particles, dust...)</td>
<td></td>
<td></td>
<td>Depends on machine configuration</td>
<td></td>
</tr>
</tbody>
</table>

- **Organic contaminations (non polar) e.g. oil, fat**: very good, very good, good, moderate
- **Organic, (polar) e.g. “combination contamination”**: moderate, moderate, very good, moderate
- **Inorganic, (polar) contamination (Salts)**: moderate, moderate, moderate - good, very good
- **Solid contamination (e.g. chips, particles, dust...)**: Depends on machine configuration
What is Modified Alcohol?

- A water-free solvent with excellent cleaning power
- A single chemistry with both polar and non-polar properties
- One chemistry that cleans parts made with oils or water based coolants
- Distillable and highly recoverable
- A non-hazardous biodegradable organic solvent
  - RoHS compliant
  - CFC free (chlorofluorocarbon free)
  - Halogen free
  - Non-flammable
- Has proven compliant to ISO 10993-5 (in-vitro cytotoxicity)
Cleaning Chemistry Options

Polarity: "Like dissolves like"

Water

δ⁻H₂O δ⁺

⇒ polar

⇒ ideal for the removal of polar soiling

Hydrocarbons

CH₃-CH₂-CH₂-CH₂-CH₃

⇒ Non-polar

⇒ ideal for the removal of non-polar soiling

"Like dissolves like"
Modified Alcohol Vacuum Vapor Degreasing

Key Benefits

✓ **Better Cleaning**
  • Low Surface Tension
  • Continuous Removal of Contaminants
  • Polar and Non-Polar Soils

✓ **Lower Operating Costs**
  • Lower Energy and Chemical Consumption
  • Stability

✓ **Green**
  • Zero Emissions Under Vacuum Operation

✓ **Safe**
  • Reduces Human Exposure
**Goals and Requirements**

**Key Factors**

1. Effective Cleaning
2. Non-HAP Solvents
3. Low VOC emissions
4. Capable of removing polar and non-polar soils
5. Meet application-specific cleaning specifications
6. Cleaning prior to painting or bonding
7. Rust prevention and protection
8. Solvent
   - Re-use
   - Low consumption
Vacuum Process Sequence

Wash #1
- Removes bulk contaminants
- High volume solution circulation/filtration
- Part rotation and oscillation
  - Ultrasonic impingement
  - Immersion degreasing

Wash #2
- Much cleaner version of Wash #1
- Immersion degrease/filtration
- Pure Solvent Vapor Rinse

(Optional) Corrosion Preventative Stage #3
- Dedicated solvent with CP additive
- Immersion soak/filtration

Vacuum Dry
Vacuum Process Sequence

Typical Cleaning and Solvent Conservation in ONE system

- Tank 3
  - Corrosion Prevention

- Tank 2 fine-cleaning or Corrosion Prevention

- Tank 1
  - Initial Cleaning

- Distillation / Vapor generator

Courtesy of Ecoclean
Vacuum Degreasing Process Flow

Process-Scheme:
# Modified Alcohol Compatibility

**Table 3: Metals and Alloys**

<table>
<thead>
<tr>
<th>Substrate</th>
<th>M6386</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024 Aluminum- Bare</td>
<td>R</td>
</tr>
<tr>
<td>2024 Aluminum- Aiclad</td>
<td>R</td>
</tr>
<tr>
<td>2024 Aluminum- Anodized</td>
<td>R</td>
</tr>
<tr>
<td>Black Anodized Aluminum</td>
<td>R</td>
</tr>
<tr>
<td>3003, 6061 and 7075 Aluminum</td>
<td>R</td>
</tr>
<tr>
<td>7075 Aluminum- Aiclad</td>
<td>R</td>
</tr>
<tr>
<td>Brass</td>
<td>R</td>
</tr>
<tr>
<td>Silver</td>
<td>R</td>
</tr>
<tr>
<td>Gold</td>
<td>R</td>
</tr>
<tr>
<td>Copper</td>
<td>R</td>
</tr>
<tr>
<td>1018 Steel</td>
<td>R</td>
</tr>
<tr>
<td>304 and 316 Stainless Steel</td>
<td>R</td>
</tr>
<tr>
<td>Magnesium</td>
<td>R</td>
</tr>
<tr>
<td>Titanium</td>
<td>R</td>
</tr>
<tr>
<td>Steel, All ASTM, SAE &amp; EN 10027</td>
<td>R</td>
</tr>
</tbody>
</table>

R = Approved Rating
# Modified Alcohol Compatibility

## Table 1: Typical Chemical and Physical Properties

<table>
<thead>
<tr>
<th>Parameter</th>
<th>100% Concentrate</th>
<th>Special Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarity</td>
<td>Clear</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>Colorless</td>
<td></td>
</tr>
<tr>
<td>Odor</td>
<td>Mild</td>
<td></td>
</tr>
<tr>
<td>Flash Point, °C (TCC)</td>
<td>61°C</td>
<td></td>
</tr>
<tr>
<td>Boiling Point, °F/°C</td>
<td>161°C</td>
<td></td>
</tr>
<tr>
<td>Volatile Organic Compound (VOC) g/L EPA Method 24</td>
<td>876.6 g/L</td>
<td></td>
</tr>
<tr>
<td>Chemical Oxygen Demand, (COD), mg/L (ppm)</td>
<td></td>
<td>232.5 †</td>
</tr>
<tr>
<td>pH</td>
<td>Not Applicable</td>
<td></td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>0.83 – 0.93</td>
<td></td>
</tr>
<tr>
<td>Weight/gallon</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>Refractive Index, ° BRIX</td>
<td>45 - 52</td>
<td></td>
</tr>
<tr>
<td>Non-volatile Residue (NVR) %</td>
<td>0.0%</td>
<td></td>
</tr>
</tbody>
</table>

Bringing Cleaning to Machining
Vacuum Degreasing
Meets Ideal Performance Goals

✓ Excellent Cleaning for Both Polar and Non-Polar Soils
✓ Effective Precision Cleaning
  ✓ Low Surface Tension
  ✓ Tight Geometries
✓ Able to Clean Parts Without Separating Them
✓ Continuous Removal of Contaminants (filtration / distillation)
✓ Rust prevention and protection (if required)
✓ Dry – Dry – Dry !!!!!
✓ Solvent
  ✓ Re-use
  ✓ Low consumption
Vacuum Degreasing Meets Ideal EH&S Goals

✓ No water required for washing or rinsing
✓ No Water To Drain
✓ Not a HAP
✓ Low VOC Emissions
✓ Low Operating Costs
✓ Lower Energy and Chemical Consumption
✓ Safe and Non-Toxic Chemistry
✓ Enclosed, Vacuum Operation Reduces Human Exposure
Vacuum Equipment Partners

- Baron Blakeslee Serec
- Cemastir
- Ecoclean
- Firbimatic
- Hoeckh
- IFP
- ILSA
- Pero
- Roll

*Approximately 28 units sold in 2018*
Sustainable Future

Today’s new solvents are replacing the older generation at a rapid pace.

WHY?
• EH&S Conditions (Corporate and Gov)
• Cost of Operations
• Compatibility of new components

Progress in new Vacuum Degreasing systems:
✓ Use considerable less solvent
✓ Generate very low emissions to the atmosphere
✓ Isolate the operator from process
✓ Usually incorporate automation for process control
Why Solvent?

The old adage that solvent cleans better, faster, and in more restrictive places than water can ever reach—is still true!

The fact that today’s cleanliness specifications for precision and critical cleaning cannot have any contaminant residue or rinse water residue on the end product ... still drives some users toward solvent.
Get Informed!

There is an abundance of information available in today’s world to consider the best cleaning method to suit your needs.

From government resources, environmental organizations, equipment suppliers, chemical suppliers, to technical papers and consultants.

There are companies that will perform cleaning analysis of your parts using a specific process to verify the results before you make a commitment. Most are free!

Use these resources to supplement your decision.
Strategic Alliances

Customers
Distributors & Representatives
Contaminant Vendors
Cleaning Equipment Manufacturers
Enablers of Technology

Bringing Cleaning to Machining
Thank You/Questions

Stop by Booth #7079 to learn more about how we can help you!

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