

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2017

DateRun: 12/28/2017

Experimenters: Alicia McCarthy, Hayley Byra

ClientType: General

ProjectNumber: Project #1

Substrates: Aluminum

PartType: Coupon

Contaminants: Lubricating/Lapping Oils, Oil

Cleaning Methods: Ultrasonics

Analytical Methods: Gravimetric

Purpose: To compare the effectiveness of alternative solvents to Trichloroethylene (TCE) when removing lubricating oils from aluminum alloy coupons.

Experimental Procedure: Aluminum coupons were vapor degreased for five minutes in heated TCE to provide a baseline for cleanliness. Fifteen coupons, three for each soil, were used for each solvent and initial weights were recorded. Coupons were soiled with Blasocut 2000 Universal Lubricant (CAS: 64742-52-5; 61790-44-1; 68608-26-4; 63449-39-8; 107-41-5; 770-35-4); Oak 7a (CAS: 64742-53-6; 68909-65-9); Rustlick EDM30 lubricant (CAS: 64742-47-8; 8042-47-5); Accu-Lube LB 6000 Lubricant (CAS 68583-51-7); and Lenox Lube Tube Wax (CAS: 8002-74-2; 57-11-4; 5989-27-5) using a swab to cover the bottom third of the substrate before taking the dirty weights. Coupons were cleaned with Opteon™ Sion SF79 and Tergo Metal Cleaner using heated (95 F) ultrasonics for five minutes. Coupons cleaned with TCE were placed back into the heated open-top vapor degreaser for five minutes. Coupons were completely submerged in the solvents during testing, and the cleaned coupons were placed on a clean foam surface. Final weights were taken shortly after testing.

Results: Opteon™ Sion SF79 and Tergo Metal Cleaner, both visually and gravimetrically, removed the lubricating oils from the coupon surface. The gravimetric results for the TCE cleaned coupons have outliers that are above 100-101 percent removal. Since only the TCE cleaned coupons had this issue, it is assumed that it is due to TCE's corrosivity to aluminum and alloys (unspecified) when unstabilized, heated, or in the presence of water^[1]. Coupons had been cleaned before use with soap and water in the laboratory, and the coupons could potentially have had water or an aqueous residue on the surface. This does not impact the results of the other two solvents.

| Cleaner | Soil | Initial wt. of cont. | Final wt. of cont. | % Removed | Average % Removal | Overall % Removal |
|---------------------|-----------|----------------------|--------------------|-----------|-------------------|-------------------|
| Opteon™ Sion SF79 | Blasocut | 0.0032 | 0.0001 | 96.88 | 97.43 | 97.79 |
| | | 0.0213 | 0.0009 | 95.77 | | |
| | | 0.0277 | 0.0001 | 99.64 | | |
| | Oak 7a | 0.0482 | 0.0000 | 100.00 | 99.16 | |
| | | 0.1101 | 0.0013 | 98.82 | | |
| | | 0.0671 | 0.0009 | 98.66 | | |
| | EDM 30 | 0.0487 | 0.0004 | 99.18 | 98.90 | |
| | | 0.0550 | 0.0010 | 98.18 | | |
| | | 0.0304 | 0.0002 | 99.34 | | |
| | Accu-Lube | -0.2474 | -0.0002 | 99.92 | 96.16 | |
| | | 0.0388 | 0.0039 | 89.95 | | |
| | | 0.1284 | 0.0018 | 98.60 | | |
| | Lenox Wax | 0.0121 | 0.0006 | 95.04 | 97.33 | |
| | | 0.0293 | 0.0005 | 98.29 | | |
| | | 0.0074 | 0.0001 | 98.65 | | |
| Tergo Metal Cleaner | Blasocut | 0.0148 | -0.0001 | 100.68 | 99.28 | 97.99 |
| | | 0.0330 | 0.0011 | 96.67 | | |
| | | 0.0395 | -0.0002 | 100.51 | | |
| | Oak 7a | 0.1240 | -0.0004 | 100.32 | 98.37 | |
| | | 0.0474 | 0.0010 | 97.89 | | |
| | | 0.0225 | 0.0007 | 96.89 | | |
| | EDM 30 | 0.0459 | -0.0004 | 100.87 | 95.63 | |
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|-----|-----------|--------|---------|--------|--------|--------|
| | | 0.0663 | 0.0027 | 95.93 | | |
| | | 0.0676 | 0.0067 | 90.09 | | |
| | Accu-Lube | 0.0494 | -0.0003 | 100.61 | 99.90 | |
| | | 0.0763 | 0.0007 | 99.08 | | |
| | | 0.1259 | 0.0000 | 100.00 | | |
| | Lenox Wax | 0.0382 | 0.0003 | 99.21 | 96.79 | |
| | | 0.0022 | 0.0002 | 90.91 | | |
| | | 0.0407 | -0.0001 | 100.25 | | |
| TCE | Blasocut | 0.0407 | 0.0001 | 99.75 | 101.39 | 101.27 |
| | | 0.0141 | 0.0004 | 97.16 | | |
| | | 0.0179 | -0.0013 | 107.26 | | |
| | Oak 7a | 0.0590 | 0.0001 | 99.83 | 100.85 | |
| | | 0.0484 | -0.0011 | 102.27 | | |
| | | 0.0658 | -0.0003 | 100.46 | | |
| | EDM 30 | 0.0324 | -0.0001 | 100.31 | 102.79 | |
| | | 0.0293 | -0.0017 | 105.80 | | |
| | | 0.0529 | -0.0012 | 102.27 | | |
| | Accu-Lube | 0.0370 | -0.0011 | 102.97 | 101.08 | |
| | | 0.0366 | -0.0001 | 100.27 | | |
| | | 0.0354 | 0.0000 | 100.00 | | |
| | Lenox Wax | 0.0449 | -0.0003 | 100.67 | 100.24 | |
| | | 0.0729 | -0.0005 | 100.69 | | |
| | | 0.0472 | 0.0003 | 99.36 | | |

[1] http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/trichloroethylene.html

Summary:

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|------------------------------------|-------------------------------|---------------|--------------------|-------------------------------------|------------------------------|
| Substrates: | Aluminum | | | | |
| Contaminants: | Lubricating/Lapping Oils, Oil | | | | |
| Company Name: | Product Name: | Conc.: | Efficiency: | Effective: | Observations: |
| Micro Care | Opteon Sion SF79 | 100% | 97.79 | <input checked="" type="checkbox"/> | |
| Micro Care | Tergo Metal Cleaning Fluid | 100% | 97.99 | <input checked="" type="checkbox"/> | |
| Ashland Specialty Chemical Company | Trichloroethylene | 100% | 101.27 | <input checked="" type="checkbox"/> | For Comparison Purposes Only |

Conclusion:

The cleaning evaluation suggests that both Opteon™ Sion SF79 and Tergo Metal Cleaner are viable replacements for TCE.