

# CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 1999

DateRun: 08/16/1999

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ClientType: Consultant

ProjectNumber: Project #1

Substrates: Ceramics, Alumina

PartType: Coupon

Contaminants: Alcohol

Cleaning Methods: Immersion/Soak

Analytical Methods: Black light, Gravimetric, Visual

Purpose: To further evaluate the effectiveness of the two best cleaners using a thicker Evanol solution.

Experimental Procedure: Two cleaning solutions and DI Water were selected for testing based on their performance from the previous trials. Two sets of the cleaning solutions were made into two percent solutions using DI water in 600 mL beakers. One set was evaluated at room temperature and the other set was heated to 130 F on a hot plate. Table 1 lists the cleaning solutions used.

Thirty coupons were wiped with Isopropyl Alcohol and air dried. The coupons were weighed to establish a baseline level of cleanliness. All 30 coupons were observed for particulate matter using an UVP Inc. Black light, Model UVL-56 longwave UV-366nm. The coupons were dipped into the Evanol and dried for 35 minutes in an oven at ~80 C. Five coupons were cleaned in each solution for five minutes using stir-bar agitation. Parts were rinsed for two minutes in DI water also with stir-bar agitation. The group cleaned at room temperature were rinsed in DI water at room temperature and the heated cleaning was rinsed with heated DI water at the same temperature.

The parts were dried in a convection oven at 212 F for 15 minutes. After allowing parts to cool to room temperature, final weights were recorded. All coupons were observed again under black light for particulate matter and any remaining Evanol. Visual observations were made on all the coupons for any visible signs of contamination.

SUBSTRATE MATERIAL: Ceramic-Alumina coupons  
 CONTAMINANTS: DuPont Evanol Concentrated (Vinyl Alcohol Polymers & Copolymers CAS#s: 9002-89-5, 25213-24-5, 54626-91-4; Methanol Bulk/Packaged CAS #: 67-56-1; Sodium Acetate CAS#: 127-09-3)  
 CONTAMINATING PROCESS USED: Dip coupons into contaminant solution and dry using convection oven between 75-90 C for 35 minutes.

Results: All three solutions were effective in removing the concentrated Evanol off of the coupons at 130 F. There was some difficulty in cleaning at room temperature. The lower temperature cleaning left visible amounts of Evanol on all of the coupons. At the elevated temperature there were only a handful of coupons with any contaminant remaining. Micro 90 performed the best at both temperatures. Table 1 lists the calculated efficiencies and Table 2 list the observations made for both black light and visual methods.

Table 2. Cleaning Efficiencies

| Cleaner  | Micro 90 | Inproclean | DI Water | Micro 90 | Inproclean | DI Water |
|----------|----------|------------|----------|----------|------------|----------|
| Coupon 1 | 82.32    | 77.43      | 79.83    | 99.87    | 95.36      | 100.2    |
| Coupon 2 | 85.3     | 80.98      | 81.94    | 99.89    | 99.17      | 99.79    |
| Coupon 3 | 77.85    | 66.53      | 85.08    | 100      | 99.49      | 99.68    |
| Coupon 4 | 85.02    | 81.77      | 73.15    | 99.91    | 99.26      | 100.08   |
| Coupon 5 | 87.31    | 81.75      | 67.3     | 100.3    | 97.12      |          |
| Coupon 6 | 86.25    |            |          |          |            |          |
| Average  | 84.01    | 77.69      | 77.46    | 99.99    | 98.08      | 99.94    |

Observations for Black Light & Visual Analysis

| Black Light | Dirty      | Cleaned    | Non Particulate | Visual |
|-------------|------------|------------|-----------------|--------|
| Coupon #    | # of Spots | # of Spots | Fluorescence    |        |

## CLEANING LABORATORY EVALUATION SUMMARY

|    |   |   |     |                          |
|----|---|---|-----|--------------------------|
| 1  | 3 | 1 |     | mostly covered & on back |
| 2  | 0 | 2 |     | mostly covered & on back |
| 3  | 2 | 2 | Yes | mostly covered & on back |
| 4  | 3 | 0 | Yes | some covered             |
| 5  | 5 | 0 | Yes | mostly covered & on back |
| 6  | 5 | 4 |     | mostly covered & on back |
| 7  | 0 | 0 | Yes | mostly covered & on back |
| 8  | 1 | 1 |     | mostly covered & on back |
| 9  | 8 | 5 |     | mostly covered & on back |
| 10 | 3 | 0 | Yes | mostly covered & on back |
| 11 | 2 | 1 |     | mostly covered & on back |
| 12 | 3 | 0 | Yes | mostly covered & on back |
| 13 | 2 | 3 | Yes | mostly covered & on back |
| 14 | 4 | 3 | Yes | mostly covered & on back |
| 15 | 0 | 1 | Yes | mostly covered & on back |
| 16 | 1 | 3 | Yes | mostly covered & on back |
| 17 | 0 | 1 |     | on back                  |
| 18 | 1 | 0 |     | little on back           |
| 19 | 6 | 0 | Yes | some on front & back     |
| 20 | 3 | 1 |     | on back                  |

## CLEANING LABORATORY EVALUATION SUMMARY

|    |    |   |  |                      |
|----|----|---|--|----------------------|
| 21 | 1  | 0 |  | on back              |
| 22 | 2  | 0 |  | some on front & back |
| 23 | 2  | 0 |  | some on front & back |
| 24 | 5  | 2 |  | on back              |
| 25 | 4  | 0 |  | on back              |
| 26 | 5  | 1 |  | some on front & back |
| 27 | 10 | 0 |  | on back              |
| 28 | 5  | 0 |  | on back              |
| 29 | 2  | 1 |  | on back              |
| 30 | 5  | 0 |  | some on front & back |

All three methods proved that the cleaning solutions were more effective at the higher temperatures

Summary:

|                                    |  |                      |               |                    |                                     |                      |
|------------------------------------|--|----------------------|---------------|--------------------|-------------------------------------|----------------------|
| <b>Substrates:</b>                 |  | Ceramics, Alumina    |               |                    |                                     |                      |
| <b>Contaminants:</b>               |  | Alcohol              |               |                    |                                     |                      |
| <b>Company Name:</b>               |  | <b>Product Name:</b> | <b>Conc.:</b> | <b>Efficiency:</b> | <b>Effective:</b>                   | <b>Observations:</b> |
| Oakite Products                    |  | Inproclean 3800      | 2             | 98.08              | <input checked="" type="checkbox"/> |                      |
| Oakite Products                    |  | Inproclean 3800      | 2             | 77.69              | <input type="checkbox"/>            |                      |
| International Products Corporation |  | Micro 90 Conc.       | 2             | 99.99              | <input checked="" type="checkbox"/> |                      |
| International Products Corporation |  | Micro 90 Conc.       | 2             | 84.01              | <input type="checkbox"/>            |                      |
| Water                              |  | DI Water             | 100           | 99.94              | <input checked="" type="checkbox"/> |                      |
| Water                              |  | DI Water             | 100           | 77.46              | <input type="checkbox"/>            |                      |

Conclusion:

Micro 90 was the most effective cleaner tested on the concentrated Evanol. All three solutions did remove over 98% of the contaminant at 130 F.