CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1999
DateRun:	08/03/1999
Experimenters:	Jason Marshall, Nicole Vayo
ClientType:	Consultant
ProjectNumber:	Project #1
Substrates:	Ceramics, Alumina
PartType:	Part
Contaminants:	Alcohol
Cleaning Methods:	Immersion/Soak
Analytical Methods:	Black light, Gravimetric, Microphotography, Visual
Purpose:	To evaluate the effectiveness of four selected cleaners based on previous testing results.

Experimental Procedure:

Four cleaning solutions 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.
Thirty coupons were wiped with Isopropyl Alcohol and air dried. The coupons were weighed to establish a baseline level of cleanliness. Ten coupons were photographed using Polaroid Microcam SLR attached to a microscope at a 10x magnification. All 30 coupons were observed for particulate matter using an UVP Inc. Black light, Model UVL-56 longwave UV-366nm. The contaminant was sprayed onto the coupons for five seconds. The ten coupons were photographed and all 30 coupons were observed for fluorescence under the black light. Three 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. The same ten coupons were photographed again. Visual observations were made on all the coupons for any visible signs of contamination.

SUBSTRATE MATERIAL: Ceramic-Alumina coupons
CONTAMINANTS: DuPont Evanol (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)

Results:

The initial viewing of the black light test showed no signs of particulate matter on the precleaned coupons. After application of the contaminant showed multiple spots of particulate matter on all of the coupons. The cleaning removed almost all of the particulate matter except on a few coupons. Visual inspection of the coupons also yield similar results, with most coupons being free of contamination. Table 2 lists the coupons and the observations made.

Table 2. Black Light and Visual Observations

Cleaning Temp RT	Coupon #	# of BL Spots	Visual
Green Thunder	2	1	
	3	Clear spot	
Inproclean 3800	8	1	
	9	1	
Micro 90	20	Clear spot	
	21	1	Clear spot
DI Water	25	Clear spot	
	27	1	
130 F			
Green Thunder	4	2	
	5	1	
	6	2	Clear spot
Inproclean 3800	10	1	
	11	4	

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	12	1	
SWR One	16	1	
	17	2	
Micro 90	18	1	
	22	3	
DI Water	28	1	
	29		Clear spot

Gravimetric analysis further gave quantitative proof that all the cleaning solutions were efficient in removing the contaminant from the ceramic coupons. Table 3 lists the calculated efficiencies for both cleaning temperatures.

Table 3. Gravimetric Analysis Results

Cleaner		GT	IC	SO	M9	DI
Temp	Coupon 1	100.00	100.00	99.70	100.00	99.01
RT	Coupon 2	101.05	100.00	100.23	100.00	100.00
	Coupon 3	99.52	100.30	100.43	99.50	99.96
	Average	100.19	100.10	100.12	99.83	99.66
Temp	Coupon 1	100.77	100.78	100.15	100.71	100.19
130	Coupon 2	100.18	100.20	101.10	100.81	99.90
	Coupon 3	99.95	100.04	100.09	100.10	100.12
	Average	100.30	100.34	100.45	100.54	100.07

Micro-photography did not yield anything conclusive. Figure 1 shows the precleaned, dirty and cleaned coupon at about 10x magnification.

Figure 1. Stages of Cleaning

Summary:

Substrates:	Ceramics, Alumina
Contaminants:	Alcohol

Company Name:	Product Name:	Conc.:	Efficiency:	Effective:	Observations:
Chemical Technologies	Green Thunder	2	100.30	☑	
Chemical Technologies	Green Thunder	2	100.19	☑	
Oakite Products	Inproclean 3800	2	100.34	☑	
Oakite Products	Inproclean 3800	2	100.10	☑	
SWR Corporation	SWR One	2	100.45	☑	
SWR Corporation	SWR One	2	100.12	☑	
International Products Corporation	Micro 90 Conc.	2	100.54	☑	
International Products Corporation	Micro 90 Conc.	2	99.83	☑	
Water	DI Water	100	100.07	☑	
Water	DI Water	100	99.66	☑	

Conclusion:

All of the chemistries tested, including DI water, were effective in removing the Evanol from the ceramic coupons. Gravimetric analysis provided quantitative data which was also backed up by two forms of qualitative assessment, visual inspection and black light fluorescence. The micro-photography did not prove to be a reliable evaluation method. This may have been due to the age of the film.