CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1999
DateRun:	05/10/1999
Experimenters:	Jason Marshall
ClientType:	Electron & Ion Technology Co
ProjectNumber:	Project #1
Substrates:	Alloys, Titanium, Alumina
PartType:	Coupon
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil
Cleaning Methods:	Ultrasonics
Analytical Methods:	Gravimetric
Purpose:	To compare three cleaners effectiveness in cleaning samples using various cleaning times.

Experimental Procedure:

The Alumina and Macor supplied parts were broken down into similar sized and shaped pieces to be used for the evaluation. This was performed according to proposed testing method for gravimetric analysis which states:
Gravimetric Analysis: Employed properly, gravimetric analysis can be the most inexpensive and revealing of all surface measurement techniques. Ideally, the part or test coupon is weighed a total of three times with the same analytical balance and under the same atmospheric conditions. Weights are taken (1) before artificial contamination, (2) after artificial contamination and (3) after cleaning. These tests should be duplicated a number oftimes to ensure reproducibility of results. Percent soil removal and standard deviations can then be calculated. Some difficulty may arise in arriving at a pre-contamination weight under actual plant/production settings, though estimates may be possible. Care must be taken in selecting near-identical substrate pieces and applying the contaminant in a consistent manner.

All parts and pieces were subjected to a pre-cleaning protocol. The current client cleaning practice was used as this pre-cleaning method. After parts were initially weighed, they were cleaned in a 9% Branson GP solution for 30 minutes in a 40 kHz ultrasonic tank heated to 140 F. After rinsing in a tap water spray for two minutes at 120 F and dried using a Master Appliance Corp, Hot-air gun model HG-301A at 500 F for five minutes, the parts were weighed. If the cleaned weights were within 0.0009 g of the original weights, the parts were accepted as being cleaned. For the parts that did not fall within this range, additional pre-cleaning cycles were completed until the final weights were in the desired range.

Once the pre-cleaning was completed, the parts were submerged into the metal working fluid for 10 seconds and then were weighed again to determine the amount of contaminant added. Next the parts were cleaned in the specified cleaning solutions and cleaned for 10- and five-minute periods. Rinsing and drying were performed as they were in the pre-cleaning phase. Once the parts returned to room temperature, final weights were recorded and cleaning efficiencies were calculated.

SUBSTRATE MATERIAL: Molybdenum parts, Alumina pieces, Titanium parts and Macor pieces
CONTAMINANTS: Metal working fluid (Hangsterfer's S-500CF_US)
CONTAMINATING PROCESS USED: Parts were immersed into contaminant for 10 seconds at room temperature.

Results:

All three products removed all of the contaminant when the 10-minute cleaning cycle was used for both concentrations evaluated. Branson was effective at both dilutions and cleaning times. Brulin was effective at the lower cleaning time for the 9% solution only. Valtech was the least effective when cleaning for five minutes. Table 2 lists the cleaning efficiencies for all concentrations and times.

Table 2. Cleaning Efficiencies at 10 and 5 Minutes

Product	Branson 9	Brulin 9	Valtech	Branson 5	Brulin 5
Time	10	10	10	10	10
Molybdenum	100.04	100.16	98.57	100.07	100.29
Alumina	100.67	100.32	103.09	101.34	101.73
Titanium	100.03	100.47	102.30	100.24	100.58
Macor	101.05	101.31	96.32	102.55	101.22
AVERAGE	100.45	100.57	100.07	101.05	100.96
Product	Branson 9	Brulin 9	Valtech	Branson 5	Brulin 5
Time	5	5	5	5	5
Molybdenum	100.70	99.76	100.93	100.59	99.73
Alumina	103.58	100.63	98.56	102.62	100.54

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Titanium	100.28	101.31	86.68	100.53	99.91
Macor	109.36	100.53	98.97	101.12	99.67
AVERAGE	103.48	100.56	96.28	101.22	99.96

Data used for calculations are included in the following Appendix.

Appendix A. Efficiency Calculations

	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Branson 9% 10 min							
Molybdenum	24.5017	24.5602	24.5017	0.0585	0.0000	100.00	
	24.6155	24.7045	24.6154	0.0890	-0.0001	100.11	
	24.6368	24.7413	24.6368	0.1045	0.0000	100.00	100.04
Alumina	8.6746	8.7858	8.6740	0.1112	-0.0006	100.54	
	8.6925	8.7235	8.6922	0.0310	-0.0003	100.97	
	8.5235	8.5819	8.5232	0.0584	-0.0003	100.51	100.67
Titanium	34.6483	34.8132	34.6483	0.1649	0.0000	100.00	
	34.6333	34.7799	34.6332	0.1466	-0.0001	100.07	100.03
Macor	7.5029	7.5314	7.5023	0.0285	-0.0006	102.11	
	7.5888	7.6183	7.5888	0.0295	0.0000	100.00	101.05
	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Branson 5% 10 min							
Molybdenum	24.5564	24.6097	24.5564	0.0533	0.0000	100.000	
	24.6422	24.7503	24.6418	0.1081	-0.0004	100.37	
	24.5574	24.6183	24.5575	0.0609	0.0001	99.84	100.07
Alumina	8.8247	8.8396	8.8243	0.0149	-0.0004	102.68	
	8.7727	8.7758	8.7727	0.0031	0.0000	100.00	101.34
Titanium	33.697	33.8793	33.696	0.1823	-0.001	100.55	
	34.5626	34.6956	34.5627	0.133	0.0001	99.92	100.24
Macor	10.7857	10.8929	10.7811	0.1072	-0.0046	104.29	
	10.9617	10.9865	10.9615	0.0248	-0.0002	100.81	102.55
	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Valtron 2% 10 min							
Molybdenum	24.5713	24.5932	24.5719	0.0219	0.0006	97.26	
	24.6167	24.6772	24.6173	0.0605	0.0006	99.01	
	24.4817	24.5167	24.4819	0.035	0.0002	99.43	98.57
Alumina	11.5616	11.5783	11.5613	0.0167	-0.0003	101.80	
	11.6885	11.6976	11.6884	0.0091	-0.0001	101.10	
	11.5750	11.5907	11.5740	0.0157	-0.0010	106.37	103.09
Titanium	18.1886	18.2308	18.1881	0.0422	-0.0005	101.18	
	18.1630	18.1835	18.1623	0.0205	-0.0007	103.41	102.30
Macor	5.8024	5.8053	5.8026	0.0029	0.0002	93.10	
	5.943	5.9853	5.9432	0.0423	0.0002	99.53	96.32
	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Branson 9% 5 min							
Molybdenum	24.5017	24.5584	24.5007	0.0567	-0.001	101.76	
	24.6154	24.6881	24.6153	0.0727	-0.0001	100.14	
	24.6368	24.6843	24.6367	0.0475	-0.0001	100.21	100.70
Alumina	8.6720	8.6834	8.6715	0.0114	-0.0005	104.39	

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	8.6910	8.7197	8.6909	0.0287	-0.0001	100.35	
	8.5210	8.5260	8.5207	0.0050	-0.0003	106.00	103.58
Titanium	34.6484	34.7211	34.648	0.0727	-0.0004	100.55	
	34.6327	24.7524	34.6338	-9.8803	0.0011	100.01	100.28
Macor	7.4998	7.5462	7.4993	0.0464	-0.0005	101.08	
	7.5868	7.5902	7.5862	0.0034	-0.0006	117.65	109.36
	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Branson 5% 5 min							
Molybdenum	24.5564	24.6297	24.5562	0.0733	-0.0002	100.27	
	24.6418	24.7079	24.6413	0.0661	-0.0005	100.76	
	24.5575	24.6239	24.557	0.0664	-0.0005	100.75	100.59
Alumina	8.8195	8.8268	8.8193	0.0073	-0.0002	102.74	
	8.7717	8.7996	8.7710	0.0279	-0.0007	102.51	102.62
Titanium	33.6999	33.8073	33.6989	0.1074	-0.001	100.93	
	34.5649	34.6443	34.5648	0.0794	-0.0001	100.13	100.53
Macor	10.7798	10.8231	10.7785	0.0433	-0.0013	103.00	
	10.9577	10.9973	10.9580	0.0396	0.0003	99.24	101.12
	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Valtech 2% 5 minutes							
Molybdenum	24.5719	24.6300	24.5713	0.0581	-0.0006	101.03	
	24.6173	24.6462	24.6171	0.0289	-0.0002	100.69	
	24.4819	24.5198	24.4815	0.0379	-0.0004	101.06	100.93
Alumina	11.5523	11.6939	11.5528	0.1416	0.0005	99.65	
	11.6860	11.6999	11.6865	0.0139	0.0005	96.40	
	11.1509	11.2030	11.1511	0.0521	0.0002	99.62	98.56
Titanium	18.1881	18.2566	18.2011	0.0685	0.0130	81.02	
	18.1623	18.2015	18.1653	0.0392	0.0030	92.35	86.68
Macor	5.7985	5.8370	5.7989	0.0385	0.0004	98.96	
	5.9409	5.9604	5.9411	0.0195	0.0002	98.97	98.97
	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Brulin 9% 10 min							
Molybdenum	24.5000	24.5670	24.5000	0.0670	0.0000	100.00	
	24.6143	24.7146	24.6143	0.1003	0.0000	100.00	
	24.6363	24.6789	24.6361	0.0426	-0.0002	100.47	100.16
Alumina	8.6681	8.6944	8.6679	0.0263	-0.0002	100.76	
	8.6887	8.7362	8.6886	0.0475	-0.0001	100.21	
	8.5177	8.5860	8.5177	0.0683	0.0000	100.00	100.32
Titanium	34.6464	34.7524	34.6456	0.106	-0.0008	100.75	
	34.6338	34.7876	34.6335	0.1538	-0.0003	100.20	100.47
Macor	7.4947	7.5615	7.4943	0.0668	-0.0004	100.60	
	7.5826	7.6024	7.5822	0.0198	-0.0004	102.02	101.31
	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Brulin 9% 5 min							
Molybdenum	24.5554	24.6485	24.5556	0.0931	0.0002	99.79	
	24.6406	24.7349	24.6408	0.0943	0.0002	99.79	
	24.5562	24.6220	24.5564	0.0658	0.0002	99.70	99.76
Alumina	8.8183	8.8510	8.8185	0.0327	0.0002	99.39	
	8.7696	8.7803	8.7694	0.0107	-0.0002	101.87	100.63
Titanium	33.6959	33.8987	33.6942	0.2028	-0.0017	100.84	

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	34.5648	34.7558	34.5614	0.1910	-0.0034	101.78	101.31
Macor	10.7778	10.8617	10.7774	0.0839	-0.0004	100.48	
	10.9548	10.9896	10.9546	0.0348	-0.0002	100.57	100.53
	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Brulin 5% 10 min							
Molybdenum	24.5703	24.6078	24.5702	0.0375	-0.0001	100.27	
	24.6163	24.7178	24.6159	0.1015	-0.0004	100.39	
	24.4805	24.5769	24.4803	0.0964	-0.0002	100.21	100.29
Alumina	11.5513	11.5744	11.5508	0.0231	-0.0005	102.16	
	11.6840	11.7530	11.6831	0.0690	-0.0009	101.30	101.73
Titanium	18.1886	18.2436	18.1879	0.0550	-0.0007	101.27	
	18.1616	18.2444	18.1617	0.0828	0.0001	99.88	100.58
Macor	5.7983	5.8219	5.7980	0.0236	-0.0003	101.27	
	5.9403	5.9743	5.9399	0.034	-0.0004	101.18	101.22
	initial wt	dirty wt	clean wt	wt of cont	final wt	%removal	Average %
Brulin 5% 5 min							
Molybdenum	24.5703	24.6514	24.5704	0.0811	0.0001	99.88	
	24.6164	24.6577	24.6165	0.0413	1.00E-04	99.76	
	24.4811	24.5941	24.4816	0.113	0.0005	99.56	99.73
Alumina	11.5487	11.6339	11.5482	0.0852	-0.0005	100.59	
	11.6814	11.7119	11.6813	0.0305	1.00E-04	100.33	
	11.5538	11.6391	11.5532	0.0853	-0.0006	100.70	100.54
Titanium	18.188	18.2862	18.1880	0.0982	0.0000	100	
	18.1622	18.2688	18.1624	0.1066	0.0002	99.81	99.91
Macor	5.7962	5.8408	5.7963	0.0446	0.0001	99.78	
	5.937	5.9837	5.9372	0.0467	0.0002	99.57	99.67

Summary:

Substrates:	Alloys, Titanium, Alumina
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil

Company Name:	Product Name:	Conc.:	Efficiency:	Effective:	Observations:
Branson Ultrasonics	GP	9	100.40	☑	
Branson Ultrasonics	GP	5	100.10	☑	
Brulin Corporation	Formula 815 GD	9	100.60	☑	
Brulin Corporation	Formula 815 GD	5	101.00	☐	
Valtech Corporation	Valtron SP 2200	2	100.10	☑	

Conclusion:

The Branson and Brulin products were nearly identical in the cleaning trials performed. The Branson product was slightly more effective at the lower concentration (5%) and time (5 min). All three products were effective in removing at least 96% of the contaminant from the parts.