CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2007
DateRun:	08/13/2007
Experimenters:	Jason Marshall
ClientType:	Optical Manufacturer
ProjectNumber:	Project #1
Substrates:	Glass/Quartz
PartType:	Part
Contaminants:	None
Cleaning Methods:	Immersion/Soak
Analytical Methods:	Gravimetric
Purpose:	To test the phosphate resistance of the eight glass samples.

Experimental Procedure:

Glass samples were delivered polished to the specified polishing conditions. Each glass sample was weighed using a analytical balance. One sample of each glass type were hung by platinum wire into 0.01 mol/liter purified tripolyphosphate at 50 deg C for the length of times specified (15 minutes, 1 hour, 4 hours or 16 hours). After this treatment, the samples were weighed again and the loss of the mass of the sample were calculated. Calculation of the time t0.1 in hours, necessary to etch a surface layer a depth of 0.1 um was done using the following formula:

t0.1 = (tedS)/[(m1-m2)*100]
where:
t0.1 = the time (min) necessary to etch a surface layer to a depth of 0.1 m
te = the time (min) for attach in the experiment
d = the specific gravity of the sample
S = the surface area (cm2) of the sample
m1 = the mass (mg) of the sample before the test
m2 = the mass (mg) of the sample after the test

Phosphate Resistance Class PR 1 2 3 4
Time t0.1 needed to etch to a depth of 0.1um/min >240 240~60 60~15 <15

In addition, changes in the surface of the sample following the treatment are qualitatively evaluated with the naked eye. Additional classification numbers are given according to the second table.

Additional Number Changes in the Surface
.0 No visible changes
.1 Clear, but irregular surface (wavy, pockmarked)
.2 Interference colors (slight selective leaching)
.3 Tenacious thin whitish layer (stronger selective)
.4 Loosely adhering thick layer (surface crust)

Results:

The target weight loss of 0.0010 grams (1 mg) was met by samples D and 4 after 60 minutes. The other 6 samples lost less than this weight. The tables list the amount of weight loss after each time interval. For the 60-minute time with D and 4 exceeding the weight loss, the calculations for t0.1 are included.

Time (te)	15			
Test sample id	m1	m2	m1-m2	
PR	A	3.8018	3.8015	0.0003
PR	B	3.8598	3.8592	0.0006
PR	C	3.7988	3.7992	-0.0004
PR	D	4.0823	4.0819	0.0004
PR	1	6.379	6.3792	-0.0002
PR	2	1.2353	1.2353	0
PR	3	1.231	1.2312	-0.0002
PR	4	1.2577	1.2576	0.0001
Time (te)	60			
Test sample id	m1	m2	m1-m2	
PR	A	3.8018	3.8015	0.0003
PR	B	3.8598	3.8592	0.0006
PR	C	3.7988	3.7983	0.0005
PR	D	4.0823	4.0808	0.0015
PR	1	6.379	6.3788	0.0002
PR	2	1.2353	1.2348	0.0005

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PR	3	1.231	1.2307	0.0003
PR	4	1.2577	1.2561	0.0016

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t0.1	density(d)	surface area(S)	d*S	time(te)	te*d*S	te*d*S/ [(m1-m2)*100]
D	2.76	45.662	126.027	60	7561.627	50410.848
4	2.23	42.327	94.389	60	5663.368	35396.05

Dt0.1 = 50410 min

4t0.1 = 35400 min

Time (te)	240			
Test sample id	m1	m2	m1-m2	
PR	A	3.8018	3.8012	0.0006
PR	B	3.8598	3.8592	0.0006
PR	C	3.7988	3.7983	0.0005
PR	1	6.379	6.3789	0.0001
PR	2	1.2353	1.2348	0.0005
PR	3	1.231	1.2304	0.0006
Time (te)	1080			
Test sample id	m1	m2	m1-m2	
PR	A	3.8018	3.801	0.0008
PR	B	3.8598	3.8592	0.0006
PR	C	3.7988	3.7981	0.0007
PR	1	6.3791	6.3787	0.0003
PR	2	1.2353	1.2348	0.0005
PR	3	1.231	1.2309	0.0001

Phosphate Resistance and Change in Surface Classifications for all eight samples.

A	PR 1.1
B	PR 1.1
C	PR 1.1
D	PR 3.1
1	PR 1.0
2	PR 1.1
3	PR 1.1
4	PR 3.1

Summary:

Conclusion: Only one sample set, D and 4 exceeded the 1 mg weight loss. The other samples except sample 1 had some signs of etching around the edges, resulting in the .1 being added to the Phosphate resistance class.