CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2021
DateRun:	03/17/2021
Experimenters:	Zoe Lawson, Justin Kiander
ClientType:	Plating Company
ProjectNumber:	Project #1
Substrates:	Aluminum
PartType:	Coupon
Contaminants:	Coatings
Cleaning Methods:	Immersion/Soak
Analytical Methods:	Gravimetric, Visual
Purpose:	The purpose of this experiment was to determine the effectiveness of HSPiP alternatives in removing the lacquer.
Experimental Procedure:	Alternatives were prepared to the following concentrations: Acetone 100%, Acetone 50%, Thiophene 100%, Cyclopentanone 100%, Anisole 100%, Dimethyl Glutarate 100%. Dimethyl Glutarate was heated to 150°F while the other alternatives were kept at room temperature. Three aluminum coupons were obtained and weighed for each of the solutions being tested. Coupons were then coated on one side with the lacquer soil and allowed to dry for 1 hour. Coupons were soiled on the opposite side and allowed to dry for an additional hour. Once both sides were soiled and dry, a dirty weight was obtained and recorded for all coupons. Coupons were then submerged into their respective solutions for 30 minutes, checking the progress of cleaning every five minutes. After 5 minutes, coupons cleaned with Acetone 100%, Thiophene, Cyclopentanone, and Dimethyl Glutarate had no lacquer coating remaining and were removed from solution. Coupons cleaned with Anisole were removed after 15 minutes of immersion. Coupons cleaned with Acetone 50% were submerged for the full 30 minutes. Coupons were allowed to dry in air for 24 hours. Following the drying period, coupons were weighed again, and a clean weight was recorded. Effectiveness of the cleaners was determined.

Results:

Cleaner	Initial wt of cont	Final wt of cont	%Cont Removed	%AVG
Acetone 100%	0.0190	-0.0001	100.53	99.56%
	0.0215	0.0004	98.14	
	0.0136	0.0000	100.00	
Acetone 50%	0.0229	0.0209	8.73	9.11%
	0.0194	0.0176	9.28	
	0.0225	0.0204	9.33	
Thiophene	0.0256	0.0061	76.17	76.74%
	0.0190	0.0043	77.37	
	0.0193	0.0045	76.68	
Cyclopentanone	0.0163	0.0000	100.00	100.72%
	0.0131	-0.0001	100.76	
	0.0142	-0.0002	101.41	
Anisole	0.0209	0.0026	87.56	87.39%
	0.0180	0.0026	85.56	
	0.0228	0.0025	89.04	
Dimethyl Glutarate	0.0256	-0.0001	100.39	108.45%
	0.0213	-0.0002	100.94	
	0.0154	-0.0037	124.03	

Dimethyl Glutarate was the most effective cleaner removing an average of 108.45% of lacquer from the aluminum substrates. Cyclopentanone and Acetone 100% were the secondary most effective solvent alternatives removing an average of 100.72 and 99.56% respectively. Percent removals over 100 indicate that the solvent has removed additional soils which were present on the coupon prior to testing.

During the cleaning process, all solutions excluding Acetone 50% underwent a color change from clear to a deep red almost immediately after adding coupons into the solution. This color change verifies that the solutions are able to remove the lacquer. For all cleaners excluding Anisole and Acetone 50%, the coating was visibly removed after 5 minutes of cleaning. After the cleaning process, it was observed that some coupons for Thiophene and Anisole possessed spots of lacquer outside of the cleaning area, which slightly impacted overall performance. For coupons cleaned with Anisole, a visible residue was present at the 5 and 10 minute marks of observation during the cleaning process. At the 15-minute mark, the residue appeared to be visibly removed. Coupons cleaned with Acetone 50% had very poor removal. There was not

CLEANING LABORATORY EVALUATION SUMMARY

a significant color change in the solution indicating poor performance in removing the lacquer from aluminum substrates.

Next steps would be to discuss with senior lab staff if further optimization is required.

Summary:

Substrates:	Aluminum				
Contaminants:	Coatings				
Company Name:	**Product Name:**	**Conc.:**	**Efficiency:**	**Effective:**	**Observations:**
J.T. Baker	Acetone	100%	99.56	☑	
J.T. Baker	Acetone	50%	9.11	☐	
Alfa Aesar	Thiophene	100%	76.74	☐	There were patches of lacquer outside the cleaning area which could have slightly impacted performance. The chemical possesses a very strong odor.
Aldrich Chemical Company Inc.	Cyclopentanone	100%	100.72	☑	
Fisher Scientific	Anisole (CAS: 100-66-3)	100%	87.39	☑	Some patches of lacquer were present outside of the cleaning area which could have slightly impacted performance.
Fisher Scientific	Dimethyl glutarate (CAS:1119-40-0)	100%	108.45	☑	

Conclusion:

Upon completion of testing, it was determined that heated immersion with Dimethyl Glutarate was the most effective alternative in removing the lacquer from aluminum substrates. Cyclopentanone and Acetone 100% at room temperature were the following most effective alternatives. Next steps would be to discuss with senior lab staff to determine if further optimization is required.