CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1997
DateRun:	06/04/1997
Experimenters:	Andrew Bray
ClientType:	Aluminum Anodizing Job Shop
ProjectNumber:	Project #1
Substrates:	Aluminum
PartType:	Part
Contaminants:	Waxes
Cleaning Methods:	
Analytical Methods:	Goniometry, Microphotography, Waterbreak
Purpose:	Determine the effectiveness of six test solutions

Experimental Procedure:

The purpose of this trial is to determine the effectiveness of six test solutions at removing the masking wax from aluminum stock prior to anodizing. Aluminum Anodizing Job Shop performed the cleaning trial. Wax was applied to each bar and allowed to set. Bars A through F were steam cleaned manually using a pressure steam gun. Bar G was left completely contaminated as a control.
Bar A was vapor degreased with trichloroethylene and Bar B received no further cleaning. Bars C, D, E, and F were cleaned in two concentrations (50% and 100%) of two commercial wax strippers (Don Garland Inc.'s Super Blue Non-Ammoniated Stripper and Zap Ammoniated Stripper). One end of the bar was cleaned by submerging it for ten minutes into a four-inch beaker containing the solution. The bars were removed and allowed to dry at ambient temperature.
A Water Break Test was performed at Aluminum Anodizing Job Shop on bars A through F. The test involved misting the parts with water and observing the wetting. The water either beaded or sheeted on the surface of the bars. The observations are listed in the Results section of the report. The bars were transported to the Surface Cleaning Lab where the MicroCam Analysis and Contact Angle Goniometry were performed. The Microcam Analysis involved placing the bars under a microscope at fifty times magnification and taking a photograph of the cleaned end and the uncontaminated end.
Contact Angle Laser Goniometry involved placing a three-microliter drop of deionized water at various sites on the surface of the bar. For this experiment, four drops were placed on each end and four drops were placed in the middle of each bar. The laser beam was aimed so that the substrate partially blocked the laser beam, and the unobstructed part of the beam just contacted the droplet edge/substrate interface. Two sharp lines appeared on the angle card. The angle between these lines is the contact angle of the water droplet with the substrate. Lower contact angles are an indication of surface cleanliness while higher angles indicate the presence of contamination. Four contact angle readings were made on each drop and recorded. The values were averaged, and the results are given below.

SUBSTRATE MATERIAL: 0.5"x0.25x12" Aluminum 6062 Bars
CONTAMINANTS: Mobilewax 2305
CONTAMINATING PROCESS USED: Bars contaminated at Aluminum Anodizing Job Shop by dipping into vat of masking wax

Results:

Water Break Test		
Bar	Cleaner Used	Observations
A	Trichloroethylene	Sheeted off
B	Steam	Beaded up
C	50% Super Blue Stripper	Beaded up
D	100% Super Blue Stripper	Sheeted off
E	50% Zap Stripper	Sheeted off
F	100% Zap Stripper	Sheeted off
G	None	Beaded up

Microcam Analysis
There was no noted difference between the end that had been cleaned and the end that was not contaminated at fifty times magnification.

Contact Angle Goniometry

Bar	Bottom	Middle	Top
	(degrees)	(degrees)	(degrees)
A	88.63	90.38	82.38
B	91.94	90.08	94.75
C	93.47	92.88	89.19
D	82.13	93	93.88
E	85.06	92.5	84.25

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F	70.56	90.81	78.19

This test was not effective at showing a difference in cleanliness between Bars A through F. Contact angle measurements were not made on Bar G because it was not possible to get an accurate reading with the presence of bulk wax because the laser beam cast no clear image.

Summary:

Substrates:	Aluminum				
Contaminants:	Waxes				
Company Name:	**Product Name:**	**Conc.:**	**Efficiency:**	**Effective:**	**Observations:**
Don Garland Inc	Super Blue Non Ammoniated Stripper	100		☐	
Don Garland Inc	Zap Ammoniated Stripper	100		☐	
Ashland Specialty Chemical Company	Trichloroethylene	100		☐	

Conclusion:

The wetting test results indicate that Bar A, D, E, and F are clean. The microscopic inspection and photography did not detect contamination on any of the Bars other than G. Microscopy was not effective at showing contamination at this magnification. The high contact angle measured at each site on Bars A through F suggests microscopic contamination is present on the surface of all bars. It appears that the parts may have become electrostatically charged, therefore interfering with the contact angle goniometry. An electrostatic charge would cause the bars to repel water, resulting in very high contact angles. The packaging material used for shipping may have caused this charge. Further testing will be done to explore this. If an electrostatic charge were present, rinsing the parts in deionized water would neutralize it. From the three analytical procedures used to analyze the effectiveness of the cleaning solutions, the water break test was most effective at showing a difference in cleanliness.