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THE CASE OF THE ELUSIVE INTENSITY

by Bob Gillespie, Premier Shot Company, Inc.

In a recent issue of "The Shot Peener", Jack Champaigne proposed that readers perform a simple test with Almen strips that involved plotting a saturation curve (qualification process), repeating this curve a number of times, peening a number of Almen strips at the saturation point, peening the same number at double the saturation time and comparing the results.

Premier Shot Company has a small shot tester that, as part of life testing of shot, one can generate the peening intensity used for testing. The machine is designed to keep all parameters constant except the media used and the number of peening cycles (which are varied depending on the peening media tested). The variables that were kept constant are: media, media flow or amount, impingement angle, distance to target, media velocity (153 feet per second), and the target (Almen strips). To assure that the media remained as consistent as possible, conditioned cut wire shot was used because it has the best durability and consistent of properties of any peening media. The nominal diameter of the shot used was 0.028 inch. Also to avoid variation, the Almen strips used were within +0.0005 inch in flatness. The only parameter varied was the exposure time (in number of passes or cycles) of the Almen strips. It was felt that this environment would be very consistent and provide a good repeatable process for which to determine saturation and run the multiples of Almen strips.

We began our first qualification test by plotting three saturation curves using 2, 4, 8, 16, and 32 cycle increments (see Table I - Curves 1-3). Now the fun begins. In these three curves, saturation (the first point at which doubling the exposure time gave no more than 10% increase in arc height) occurred at: 15.5A and 16 cycles for Curve 1, 14.0A and 8 cycles for Curve 2, and 15.0A and 16 cycles for Curve 3. Since the saturation point was different in all three curves, we were uncertain which time to select for saturation and two times saturation.

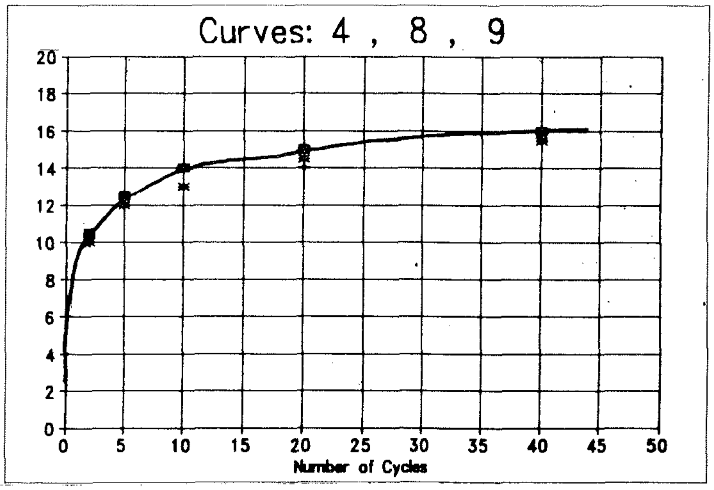
We then decided to run six more saturation curves: three at 2, 5, 10, 20 and 40 cycles and three at 3, 6, 12, 24 and 48 cycles. It was reasoned that the peening process itself should determine the saturation point and the exposure increments should not effect the results. The results for the 2, 5, 10, 20 and 40 cycle curves showed saturation at: 14.0A and 10 cycles for Curve 8, and 12.0A and 5 cycles at curve 9. The curves using 3, 6, 12, 24 and 48 cycles showed saturation at: 13.0A and 6 cycles for Curve 5, 13.0A and 3 cycles for curve 6, and 16.0A and 24 cycles for Curve 7.

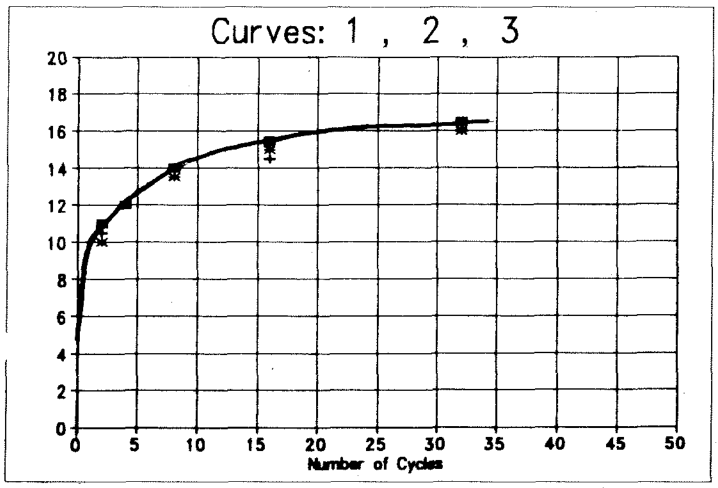
Now we have nine saturation curves for the very same process where saturation occurs from a 12.0A to a 16.0A intensity and from 3 cycles to 24 cycles in time. What is the saturation point, in intensity and cycles (time) for this process? What time should be used for two times saturation? I am very interested in the opinions and input from the readers as to where they would place the saturation point of this process and where two times saturation would be. I have my own opinion, but I would like to hear from others. I look forward to the replies.

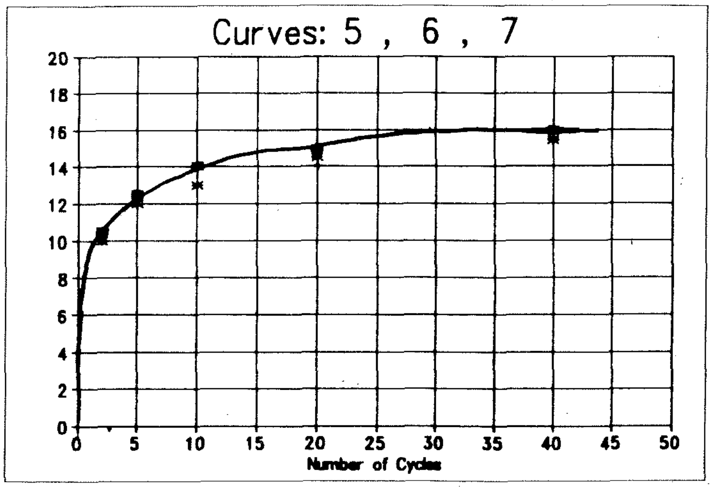
Editor's note: Please respond to Bob c/o The Shot Peener. Replies will be published in the Fall edition

ALMEN A STRIP ARC HEIGHT
(0.001 inch)

Number of Cycles	Curve 1	2	3	4	5	6	7	8	9
2	11.0	10.5	10.0	10.5				10.0	10.0
3					11.5	12.0	10.5		
4	12.0	12.0	12.0						
5				12.5				12.0	12.0
6					13.0	13.0	12.5		
8	14.0	14.0	13.5						
10				14.0				14.0	13.0
12					14.0	14.0	14.0		
16	15.5	14.5	15.0						
20				15.0				14.0	14.5
24					14.5	15.0	16.0		
32	16.5	16.0	16.0						
40				16.0				15.5	15.5
48					16.0	15.5	17.0		
Cycles to Saturation	16.0	8.0	16.0	10.0	6.0	3.0	24.0	10.0	5.0
Intensity at Saturation	15.5	14.0	15.0	14.0	13.0	13.0	16.0	14.0	12.0







THE AIRCRAFT COATINGS REMOVAL ISSUE

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SODIUM BICARBONATE: A specially formulated and classified sodium bicarbonate powder is propelled via direct pressure blasting with a modest amount of water injected at the nozzle to control dusting. The product has been shown to remove aircraft paint systems. Early concerns about corrosion have been reduced through the introduction of corrosion inhibitors and the process has been approved on a limited basis. Sodium Bicarbonate is innocuous and water soluble. However, it cannot be recycled like the plastic media products. A fair amount of waste must be treated to separate the dissolved sodium bicarbonate from the residual paint.

CARBON DIOXIDE/DRY ICE: Liquid carbon dioxide is frozen, ground, classified and propelled upon the aircraft surface again via direct pressure blasting. Testing to date has shown the process to be very slow and there are some concerns remaining about residual stress. Tests are planned combining carbon dioxide with flashlamps to increase the surface temperature differential and cause thermal stripping rather than mechanical abrading. The EPA advantage is obvious as the carbon dioxide goes away by itself following blasting and all that is left are the paint chips.

WHEAT STARCH: Specially formulated, polymerized, ground and classified wheat starch is under evaluation for use by the industry. Like sodium bicarbonate, the wheat starch is water soluble, offering environmental advantages. Early testing revealed expected media flow problems associated with high humidity. However, this problem is being addressed by the manufacturer. As this material offers the recycling advantages of plastic media with some of the environmental advantages of other alternatives, further development and testing is warranted.

LASERS are being evaluated for paint removal from aircraft alloys and composites and offer promise in highly critical applications where coatings must be removed selectively. While it appears that lasers can be developed to the point that they can be used in commercial applications, robotic controls will be needed and air scrubbing equipment will be required for the blasting facility. The cost will be very high for selective applications and airframe turnaround time may be too slow for use on complete aircraft.

FLASHLAMPS with fewer light pulses per unit of time are intended to burn off the coating without volatizing it and causing air pollution problems. If sufficient strip rates can be obtained, the process might become viable, however robotics will likely be required to control the process.

HIGH PRESSURE WATER/ICE: Evaluation continues, however strip rates have been very low and overall economics and turnaround time are areas of concern. High pressure water, of course, has been used in combination with appropriate cleaning agents for cleaning aircraft skins.

THE COURSE OF ACTION

Early alternative coating removal testing at Hill AFB was fairly straightforward. The test matrix included one airframe (F-4), three alternative plastic medias (polyester, urea and melamine) and a modest number of blasting parameter alternatives. The media manufacturer was able to work with the Air Force on a joint evaluation program.

Today we have airframe and substrate alternatives too numerous to list and an ever growing number of alternative stripping approaches, all of which perform best under differing process parameters.

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Coating removal contractors would welcome new alternative approaches. However, each alternative product or process must be "approved" before it can be used on the aircraft.

Returning to the earlier model and defining the "business" as the manufacture of equipment and supplies used in the coating removal process, we have the situation shown in Exhibit C.

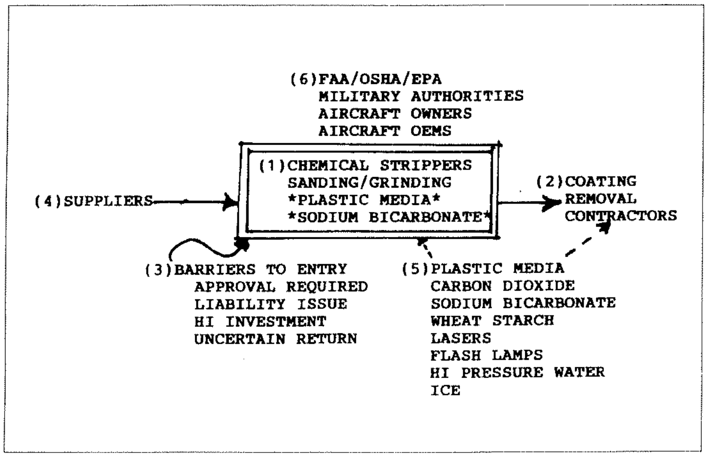

EXHIBIT C

The problem in Exhibit C is clear. The customer (coating removal contractor) cannot approve new methods for paint stripping on his own. Manufacturers trying to enter the business described in Exhibit C need to go through the regulators/approvers before the coating contractors can use their products.

However, there is no "general criteria" established by the regulators/approvers which the alternative coating removal processes must meet. Approvals that exist so far are based upon testing done on a case-by-case basis.

What we are faced with is a variety of emerging alternative approaches to serve an undefined market need. The market need must be defined by FAA/OSHA/EPA, Aircraft Owners, Aircraft OEM's, Aircraft Component Manufacturers and military authorities.

We have a situation where processes are being approved because they have been shown to be no more damaging than current paint stripping methods. This is probably a valid approach in the absence of a good data base of technical information.

In order to get away from the "case-by-case" approval process, we need to get good technical information flowing to the approvers/regulators.

An "Aircraft Coatings Removal Association" with the involvement and input of all segments of the Industry is one possible answer. If we can get the necessary communication going, we have the opportunity to improve worker safety and the environment by implementing cost effective alternative coating removal processes which could be supported by a technical data base.

No one segment of the Industry can do it alone. However, if the "regulators/approvers" and the "aircraft owners" lead the way, the issue will be resolved.

Bingo No. 3