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SCRATCH FILLING CHARACTERISTICS OF VARIOUS SIFCO DALIC PROCESS DEPOSITS

Test work was carried out to quantitatively verify some qualitative "facts" that based on practical experience, that is:

1. The SIFCO DALIC Silver Code 3083 Solution and the SIFCO DALIC Copper Code 2050 Solution have superior throwing power characteristics for scratch and pit-filling
2. Deeper defects are more than proportionately harder to fill than shallow defects.
3. That pits and defects should be dished out to assist "throwing" into the bottom.

A ground steel plate was machined to provide 4 scratches as deep as compared to the width as possible. Two were machined nominally 0.005" in. deep and two 0.015" in. deep. One of the deep and one of the shallow scratches were opened up with a small file to increase the width to depth ratio.

One in. by one in. areas were then plated with five different plating solutions to give 0.005 in. thick deposits. The plating solutions selected were Copper Code 2050, Copper Code 2052, Nickel Code 2080, Nickel Code 2085, and Silver Code 3083. In each case, the 1 in. x 1 in. areas contained all four scratches, since the scratches were 0.010 in. apart.

Metallographic samples were prepared to show the plate distributed in the various scratches. Thickness of deposit measurements were made using a calibrated eyepiece on a metallograph at the bottom of the scratch, at the external corners where the scratch meets the flat face, and at the flat face a short distance from the scratch. Depth and width of the scratch measurements were also made the same way. The results were as follows:

AVERAGE DEPTH, WIDTH, AND WIDTH TO DEPTH RATIO OF SCRATCHES

Type of Scratch	Width In.	Depth In.	Ratio W/D
Shallow Blend	0.032	0.0051	6.3
Shallow Sharp	0.017	0.0058	2.9
Deep Blend	0.066	0.015	4.4
Deep Sharp	0.039	0.015	2.6

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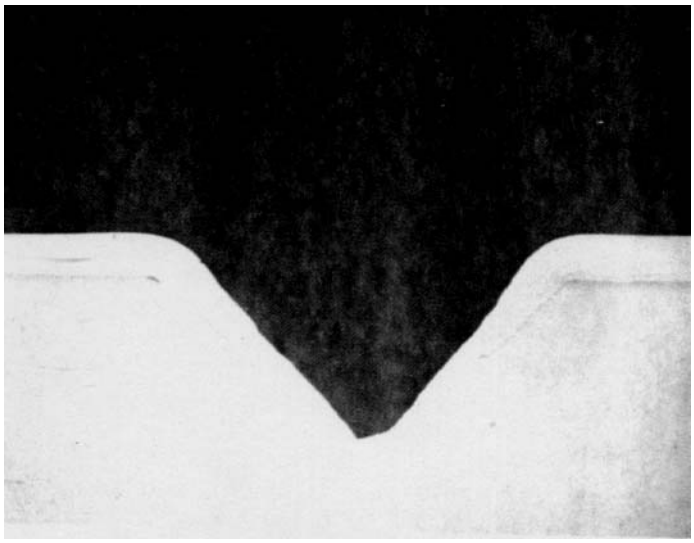
THICKNESS IN MILS OF VARIOUS DEPOSITS IN VARIOUS LOCATIONS OF VARIOUS TYPES OF SCRATCHES

Deposit	Location	Shallow Blend	Shallow Sharp	Deep Blend	Deep Sharp
Silver 3083	Flat	6.1	6.2	6.3	6.8
	Ext Cor	6.2	6.3	6.7	7.2
	Bottom	3.9	4.5	3.5	3.4
Nickel 2080	Flat	2.9	3.1	3.0	3.1
	Ext Cor	3.1	3.3	3.3	3.3
	Bottom	2.2	1.4	1.5	1.4
Copper 2050	Flat	4.6	4.3	4.4	4.7
	Ext Cor	4.6	4.3	4.7	4.9
	Bottom	2.7	2.3	2.5	1.5
Copper 2052	Flat	3.4	3.5	3.9	3.5
	Ext Cor	4.5	4.7	5.9	5.0
	Bottom	1.9	1.8	1.5	1.2
Nickel 2085	Flat	4.6	4.9	4.7	5.3
	Ext Cor	4.8	5.4	5.3	6.2
	Bottom	1.6	0.8	1.5	0.6

RATIONS OF THICKNESS OF VARIOUS DEPOSITS IN VARIOUS LOCATIONS OF VARIOUS TYPES OF SCRATCHES AS COMPARED TO THICKNESS AT ADJACENT FLAT AREAS

Deposit	Location	Shallow Blend	Shallow Sharp	Deep Blend	Deep Sharp	Ave.
Silver 3083	Ext Cor	1.02	1.02	1.06	1.06	1.04
	Bottom	0.64	0.73	0.56	0.50	0.61
Nickel 2080	Ext Cor	1.07	1.06	1.10	1.06	1.07
	Bottom	0.76	0.45	0.50	0.45	0.54
Copper 2050	Ext Cor	1.00	1.00	1.51	1.04	1.04
	Bottom	0.59	0.53	0.39	0.32	0.50
Copper 2052	Ext Cor	1.32	1.35	1.51	1.42	1.38
	Bottom	0.56	0.52	0.39	0.34	0.45
Nickel 2085	Ext Cor	1.05	1.10	1.12	1.17	1.11
	Bottom	0.35	0.16	0.32	0.13	0.24
Average Ratio at Bottom		0.54	0.45	0.45	0.32	



Photomicrograph of a Copper Code 2050 Deposit Plated in a Deep, Sharp Scratch – 50X

DISCUSSION OF RESULTS

The Silver Code 3083 and Copper Code 2050 Solutions are often selected for pit-filling applications because of the following desirable plating and/or deposit characteristics:

1. Good plating characteristics at room temperature.
2. Ability to plate to high thicknesses before the deposit becomes rough.
3. Ease with which they can be reactivated.
4. Ease with which excess stock can be removed.
5. Good throwing power.

Both solutions did exhibit good throwing power with Silver Code 3083 being somewhat superior.

The Nickel Code 2080 Solution showed surprisingly good throwing power. Its poor properties relative to the other characteristics desired for a pit-filler, however, limits its use to shallow defects where a hard pit-filler is a must.

The Copper Code 2052 Solution showed good throwing power, but its tendency to get rough quickly and build up at external corners limits its use.

The Nickel 2085 Solution showed poor throwing power.

As was expected, deeper scratches were more than proportionately harder to fill as compared to shallow scratches.

Widening out scratches improved throwing into the bottom of a scratch, but not as much as was expected. The results suggest smooth contours at the bottom are more important than width to depth ratio. It appears defects less than 0.005 in. deep need not be dished out.