Litton AMECOM
College Park, Maryland 20740

OFFICE CORRESPONDENCE

FILE :

DATE : 10/25/85

SUBJECT : Pin Diode Ribbon Failures

TO : W. Burns M/S: COPIES TO :

FROM : K.J. Ely/S.E. Dahne M/S:

Please find attached a detailed report concerning our investigation into pin diode failures on E2C Bite packages. The report details not only the probable causes but includes recommendations to preclude or at least greatly reduce future failures.

Savings from implementation of new process methodology will be an estimated $399,691 a year in parts and labor and 17,903 hours of production cycle time.

Scott E. Dahne
S. E. Dahne

K. J. Ely

SAVINGS BASED ON IMPLEMENTATION OF REBONDING PROCEDURE FOR PIN DIODES

Current Annual Part Usage - Based on 100% Build

11 pin diodes/bite package (average over all bands)

60 bite packages/month

7920 diodes/year

Current Annual Part Usage - Actual

(Based upon analysis of Purchasing, Receiving and PIC records)

15,015 diodes/year

Current Annual Part and Labor Losses

1155	diodes lost due to bad packaging/year
5940	diodes replaced due to ribbon breakage/year
7095	diodes/yr

7095 diodes x $6.75/diode = $47,891.25

5940 diodes replaced @ 1.00 hrs labor/diode = 5940 labor hours

5940 diodes replaced @ 2.5 hrs production time/diode = 14,850 hours production time (production time based on 1 1/2 hour epoxy cure time)

SAVINGS IN TEST

477 bite packages on FTR/YR @ 6.4 hrs/FTR & RE test = 3053 hrs

3053 hrs x $40.00/hr = $122,120

Implementation of New Rebonding Procedure

7920 diodes/yr x 0.025 hrs labor/diode = 198 labor hours

TOTAL SAVINGS

Labor	Hours	$
Assembly	5742	229,680
Test	3053	122,120
Production Time		
Assembly Cycle	14,850	
Test Cycle	3,053	
Parts		
7095 diodes		47,391
		$399,691

REPORT

PIN DIODE RIBBON FAILURES ON E2C BITE (P/N 174311-1)

K.J. ELY S.E. DAHNE

10-24-85

PROBLEM STATEMENT

E2C bite packages use chip diodes as an integral part of the switch coupler design. The diodes are vendor supplied (by New England Microwave) with a .005" (wide) x .0005" (thick) gold ribbon thermosonically bonded to a gold pedestal. This ribbon becomes unbonded at various stages during bite processing, causing numerous electrical failures and subsequent rework. Figure 1b indicates the magnitude of the problem.

OBJECTIVE

Process Engineering and Advanced Manufacturing Engineering accepted the task of determining the root cause of the failures. Once the cause was determined, short term and long term corrective actions would be implemented.

SUMMARY

Numerous diodes were pull tested and examined by scanning electron microscopy (SEM). The SEM revealed the failure mode and indicated the level of contamination present on the bonding pad. Most significant in this effort was the conclusion that no bonding was shown to occur in the center portion of the bonding pad. The majority of failures have no effect on the gold metallization (figure 8a). When bonding does occur, it appears only at the perimeter of the bonding pad.

In an effort to improve this bond, sample diodes were rebonded using the Mech-El wedgebonder resident in the clean room. When the proper tool is used wherein the bonding area of the tool is in the center of the pad, significant gold to gold bonding occurs. An example of an in-house rebonded diode is shown in Figure 9.

In addition, during pull test of the diodes it was clear that significant elongation of the ribbon occurs above 7.0 grams pull. The use of 10.0 grams as a criteria for acceptance, with no mention of a standard deviation, will not guarantee ribbon integrity. At this level of stress we are now testing the ribbon and not so much the ribbon to pad bond. (Note: The bare ribbon tests in excess of 20 grams.)

CONCLUSIONS

1. The failure mode indicates that little or no bonding is occurring on the pad. This will lead to marginal pull strengths and/or pull strengths which are vastly affected by outside forces (i.e. heat, twisting and contamination of leads).

2. The ten gram pull strength requirement and use of mil-spec AQL criteria is insufficient to guarantee ribbon integrity.

3. High failure rates will continue to occur until a process is developed by the vendor which achieves gold to gold welding in the center portion of the bonding pad (i.e. the vendor must update his process).

RECOMMENDATIONS

1. Some 4,000 diodes are in-house which exhibit unreliable bonds. These units should be assembled into Bite packages as normal and rebonded using the Mech-El wedgebonder. All diodes should be rebonded prior to test. See Figures 4 and 5.

2. I.E. should continue development of the ribbon bonding process on bare diodes. Once the process is optimized the vendor shall be educated on our technique.

3. The accept/reject levels should reflect good control across all lots. That is, each different lot should be tested per AQL standards to 7.5 grams with a standard deviation of 1.0 or less. Without inclusion of the standard deviation requirement we allow the vendor to be out of control.

4. If and when gold plated microstrip can be implemented into Bite assemblies the optimum fix would be to purchase unleaded devices and simply wirebond the interconnections using 1.0 mil gold wire as required.

BACKGROUND

As shown in Figure 1b the pin diode (174311-1) represents approximately seventy five percent of all Bite package rejects. This pattern of rejects has been more or less consistent over the past two years. Initially, it was felt that pull strength was the primary driver in determining lot acceptance. As a result, the accept criteria was moved from 7.5 grams to 10.0 grams when using a 1.0% AQL. (Note: This 1.0% AQL was erroneously waived to 2.5% for several recent lots). Diodes are manufactured in individual lots of 200 pieces. Lot submission from the vendor is not by individual lot but as one lot containing all of the diodes. Source inspection pulls a test sample from the overall lot which does not allow testing of all individual lots submitted. Based upon a 2.5% AQL, the sample size on a typical lot of 5,000 diodes containing 25 individual lots would be 200 diodes. The sample on each sublot of 200 diodes would only be 8 diodes whereas the required sample size of a lot of 200 parts is 32 parts (figure 6). The average pull strength on all lots we tested was 10.13 grams (figure 2 and 3) but the average standard deviation was 3.60 grams. A standard deviation of 3.60 grams is much too high for accurate data collection and should be less than 1.0 grams. Based upon sample size, method of sampling, and results of statistical analysis on data collected, our sampling plan is not giving us the data required for proper evaluation of bond pull strength.

In an effort to determine the correlation between bond appearance and bond strength, a study was performed using 16 diodes from a single lot. Factors looked at included appearance of actual bonding tool mark, centering of ribbon on mesa, deformation of ribbon surface, and angular deformation of ribbon around bonding point. Evaluation for data (figure 12) indicates no correlation between visual appearance of bond and actual bond strength.

Several potential causes of bond failures were looked at in an attempt to reduce failures during assembly and test operations. Packaging of diodes from the vendor was inadequate causing ribbons to break off diodes during shipment. Average losses due to packaging have been 1-2 diodes in each package of 18 parts (5-10%). The vendor has been contacted and new packaging techniques have been instituted resulting in no packaging related damage in the last 2,000 diodes received.

Handling of diodes by operators has not resulted in any appreciable failures to date. Several of the assembly operations require the operator to flex the diode ribbon, however, our lead fatigue testing at the vendor has screened out any possible problems due to lead fatigue. Diode handling does not appear to be a major contributory factor in failures.

Diode placement into the circuit (figure 13b) is a manual operation using tweezers. Potential causes of failure during placement include nicking the gold ribbon with the tweezers as well as ribbon breakage due to sheer or pull stresses when actual insertion occurs. The low occurrence of failures during placement coupled with the lack of a better manual placement technique eliminates the placement operation as a potential area for failure reduction.

The lead trimming and soldering operations seem to be the area where major failures start occurring. A minor amount of failures occur while the leads are being trimmed with a X-acto knife. The trimming operation places a pulling stress on the leads which can cause weakening of the bond and potential failure. Attempts are being made to coordinate with the vendor for leads which are precut to the correct length. The ideal lead length has been determined and vendor response is being awaited.

The soldering operation is the major cause of bond failures during the assembly process. The soldering process to attach the gold ribbon to the circuit requires a minimum of 500 degrees Fahrenheit to reflow the solder. Gold ribbon is an excellent conductor of heat and carries the heat of the soldering iron directly to the mesa location. The bonding process is thermosonic in nature and the application of excessive heat after bonding is complete seems to lead to a premature failure of the bond. The bond pad shows no damage when the ribbon pulls off process during soldering (figure 10) thus confirming the fact that the bond is not welding the ribbon and the bond pad. Ribbons which are rebonded using our in-house equipment show major pad damage (figure 9) when the ribbon is pulled off which confirms that the vendor supplied bond is not welding the gold ribbon across the entire surface area of the pad but only around its periphery (figure 8).

Comparison of several diodes mesas show differences in shape and surface texture. A typical diode (figure 10a) shows a fairly smooth surface which provides a good bonding surface. Several diode surfaces show excessive rough gold particles adhering to the top layer of gold (figure 8b) and also gross deformation of the bonding mesa (figure 11). Analysis of the surface of a diode mesa (figure 7) using Energy Dispersive Spectroscopy (EDS) shows silicon (Si), gold (Au), palladium (Pd), titanium (Ti), and nickel (Ni). The presence of excessive silicon on a bonding pad could prevent adherence of the gold ribbon and lead to a possible failure due to the inability of silicon to weld with the gold.

The process of tuning the bite circuits involves manipulation of the gold ribbons and addition of gold tabs to the circuit traces. Manipulation of the gold ribbons has caused failures in the past due to the force which is used to press against the bond pad and pull against the ribbon. Test Engineering has been informed of the problem and will attempt to minimize contact with the bond pad area. The soldering of gold tabs to the circuit is the major reason for failure during tuning of circuits. The soldering causes failure for the same reasons seen in assembly soldering. The method to eliminate the problems caused by soldering tabs would be to use gold circuits and wedge bond the tabs to the circuit.

Analysis and Data

As mentioned previously, numerous pull tests and SEM inspections were performed to determine the cause of failures. The tables, graphs, and photographs which follow form the basis for our recommendations. Of special note is figure 5, which clearly indicates the level of success achieved by rebonding prior to test.

BITE PACKAGE REJECTS
(6/1/85 - 9/26/85)

PART	PART NUMBER	BAND I	BAND II	BAND III	BAND IV	TOTAL	TOTAL %
PIN DIODE	174311-1	14	53	53	39	159	74.6%
MOS CAP	174518-1	2	4	6	12	24	11.3%
CONNECTOR	174517-1	1		3	11	15	7.0%
INDUCTOR	172792-2		1	1	1	3	1.4%
STRIPLINE	174186-1	3				3	1.4%
RESISTOR	173128-2		2			2	0.9%
STRIPLINE	174215-1				2	2	0.9%
STRIPLINE	174195-1		2			2	0.9%
FILTER	20C2906-1		1			1	0.5%
MICRO CAP	173154-2	1				1	0.5%
STRIPLINE	174210-1				1	1	0.5%
TOTAL		21	63	63	66	213	100.0%

Fig 1a

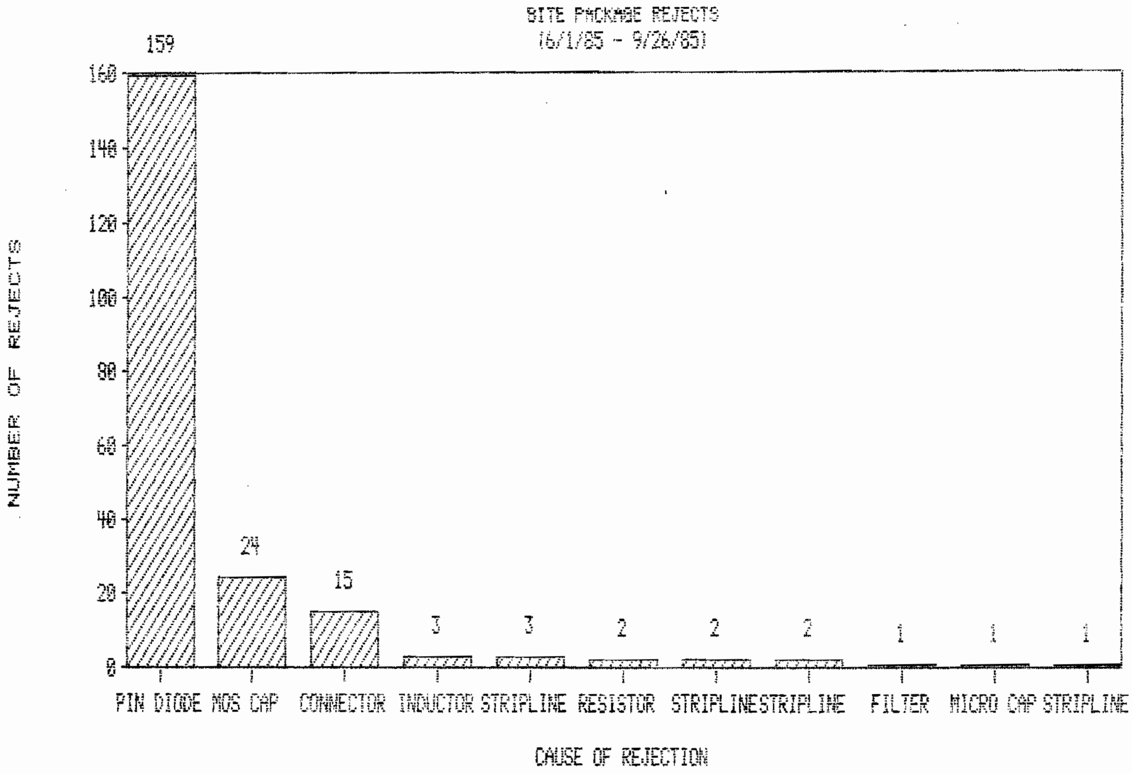


Fig 1b

PULL TESTS ON NEWEST LOTS OF PIN DIODES (174311-1)
(LEADS SOLDERED TO TEST SUBSTRATE)

LOT NUMBER	PULL STRENGTH (GRAMS)	AVERAGE PULL STRENGTH (GRAMS)	STANDARD DEVIATION (GRAMS)
19	6.9	6.80	4.10
	6.5		
	12.7		
	1.1		
20	9.6	11.15	3.72
	12.0		
	16.6		
	6.4		
21	13.3	8.63	5.31
	12.7		
	8.5		
	0.0		
22	0.0	6.18	3.79
	6.2		
	8.8		
	9.7		
23	11.1	9.70	2.48
	11.3		
	11.0		
	5.4		
24	7.4	1.85	3.20
	0.0		
	0.0		
	0.0		
25	7.5	4.18	4.22
	9.2		
	0.0		
	0.0		
26	6.1	12.25	3.84
	12.6		
	16.6		
	13.7		
27	14.7	12.73	3.60
	17.2		
	11.4		
	7.6		
28	12.5	9.45	5.57
	14.2		
	11.1		
	0.0		
29	19.5	15.20	2.85
	12.3		
	13.0		
	16.0		
30	6.5	11.88	3.11
	14.1		
	13.5		
	13.4		
TOTAL FOR ALL LOTS		9.16	3.82

Fig 2

PULL TESTS ON NEWEST LOTS OF PIN DIODES (174311-1)
(LEADS EPOXIED TO TEST SUBSTRATE)

LOT NUMBER	PULL STRENGTH (GRAMS)	AVERAGE PULL STRENGTH (GRAMS)	STANDARD DEVIATION (GRAMS)
19	13.7	11.20	2.79
	12.6		
	7.3		
20	11.2	9.30	1.22
	9.1		
	9.1		
	7.8		
22	20.0	12.45	4.36
	10.0		
	10.0		
	9.8		
24	9.0	6.95	1.23
	6.8		
	6.0		
	6.0		
25	20.0	14.10	4.09
	15.4		
	12.0		
	9.0		
29	20.0	12.60	6.56
	20.0		
	10.0		
	10.0		
	3.0		
TOTAL FOR ALL LOTS		11.10	3.38

Fig 3

RESULTS OF TESTING USING DIODES FROM LOTS WITH HIGHER PULL STRENGTHS (NO ADDITIONAL BONDING DONE PRIOR TO TESTING)

BAND	SERIAL NUMBER	FAILURES DUE TO DIODE BONDS
I	1505	0
I	1506	5
I	1507	1
I	1508	0
I	1509	3
I	1510	0

BASED ON 10 DIODES PER UNIT THIS IS AN 85.0% YIELD

DIODES FROM LOTS 26,27,29, AND 30

Fig 4

RESULTS OF REBONDING ALL DIODE RIBBONS AFTER SOLDERING OPERATIONS ARE COMPLETE

BAND	SERIAL NUMBER	FAILURES DUE TO DIODE BONDS
I	1504	0
I	1511	0
I	1512	0
I	1513	0
I	1514	0
I	1515	0
I	1516	0
I	1517	0
I	1518	0
IV	1415	2
IV	1416	0
IV	1417	0
IV	1418	0

BASED ON 10 DIODES PER UNIT THIS IS A 98.5% YIELD

Fig 5

SAMPLING PLANS

LOT SIZE	SAMPLE SIZE	1.0 % AQL ACCEPT	 REJECT	MAX % BAD IN ACC LOT	2.5 % AQL ACCEPT	 REJECT	MAX % BAD IN ACC LOT
2-8	2	0	1	0.0%	0	1	0.0%
9-15	3	0	1	0.0%	0	1	0.0%
16-25	5	0	1	0.0%	0	1	0.0%
26-50	8	0	1	0.0%	0	1	0.0%
51-90	13	0	1	0.0%	1	2	7.7%
91-150	20	0	1	0.0%	1	2	5.0%
151-280	32	1	2	3.1%	2	3	6.3%
281-500	50	1	2	2.0%	3	4	6.0%
501-1200	80	2	3	2.5%	5	6	6.3%
1201-3200	125	3	4	2.4%	7	8	5.6%
3201-10000	200	5	6	2.5%	10	11	5.0%
10001-35000	315	7	8	2.2%	14	15	4.4%

Fig 6

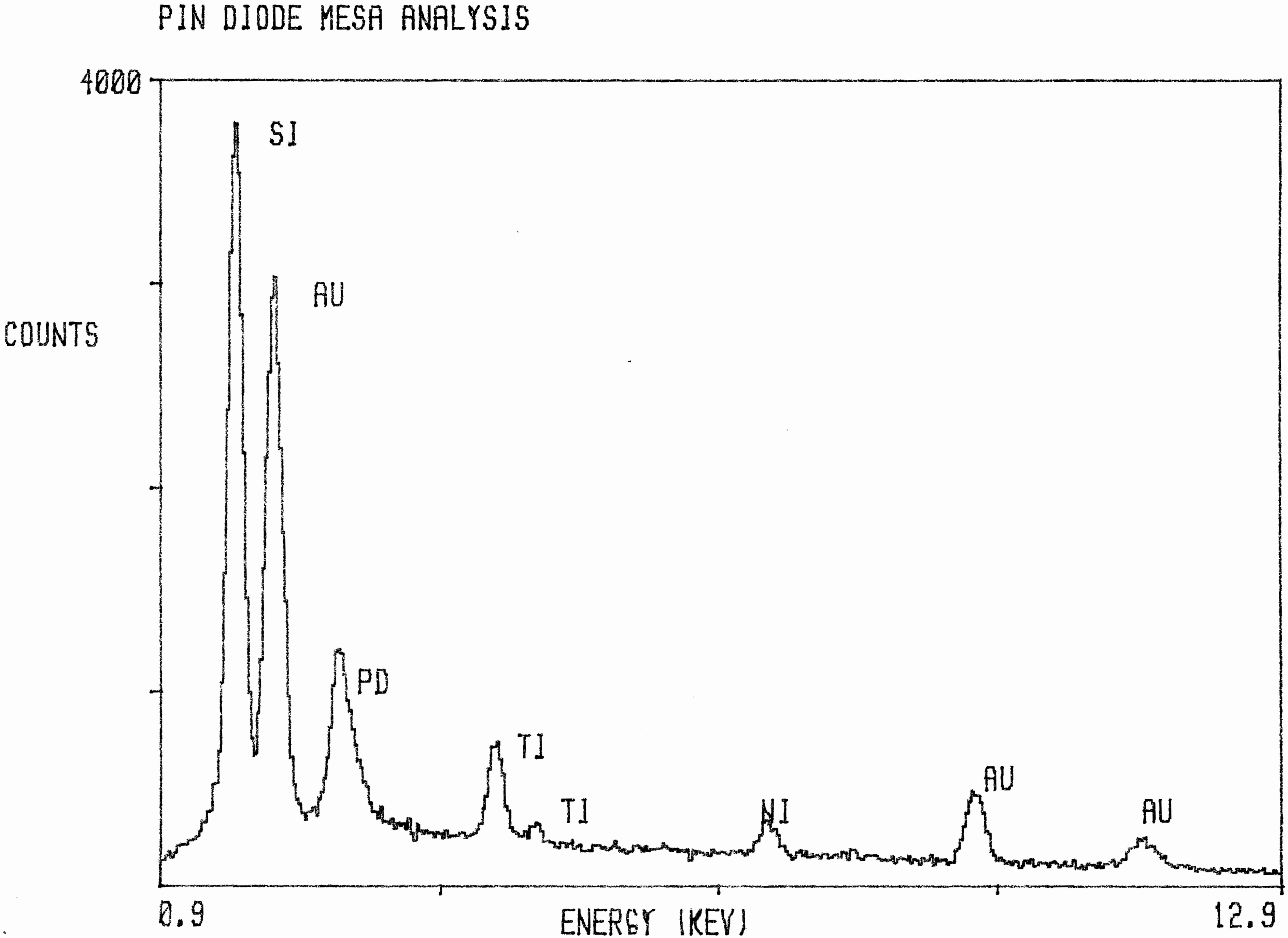

PIN DIODE MESA ANALYSIS
4000
COUNTS
SI
AU
PD
TI
TI
NI
AU
AU
0.9
ENERGY (KEV)
12.9

Fig 7

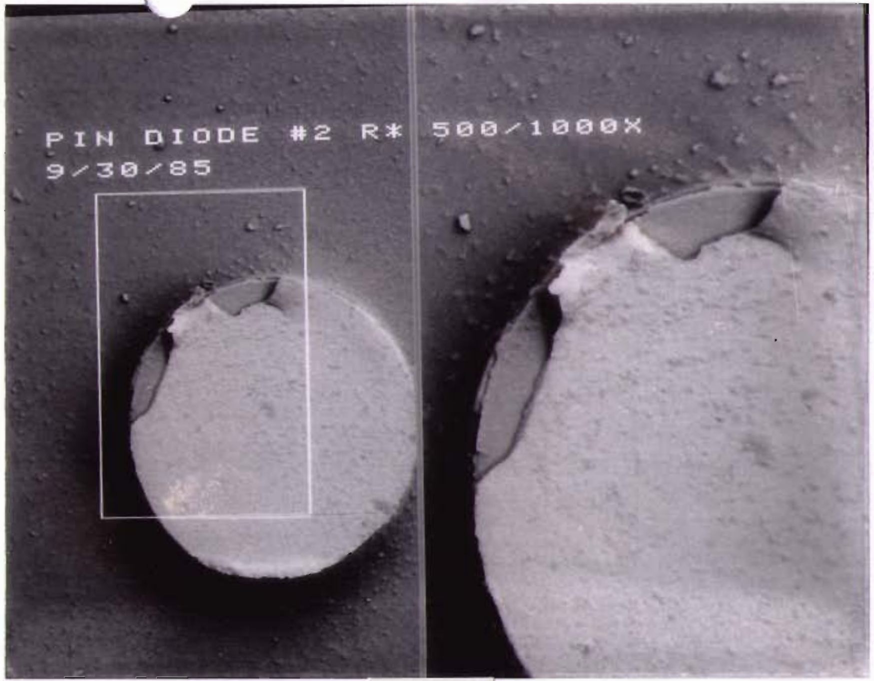


Fig 8a

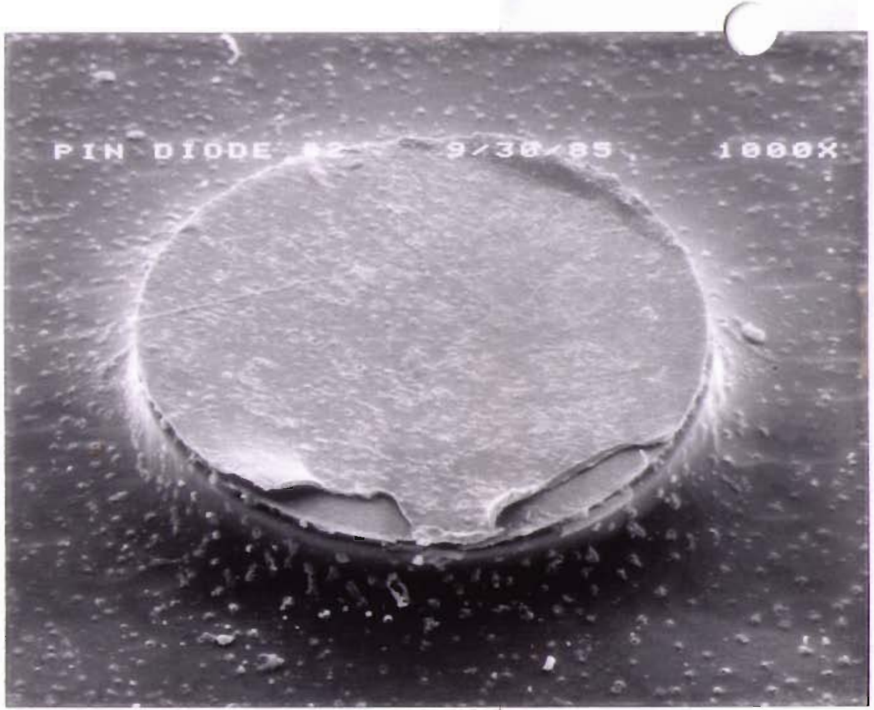


Fig 8b

Al
Pd
Ti
Ni

Fig 8c

Fig 8d

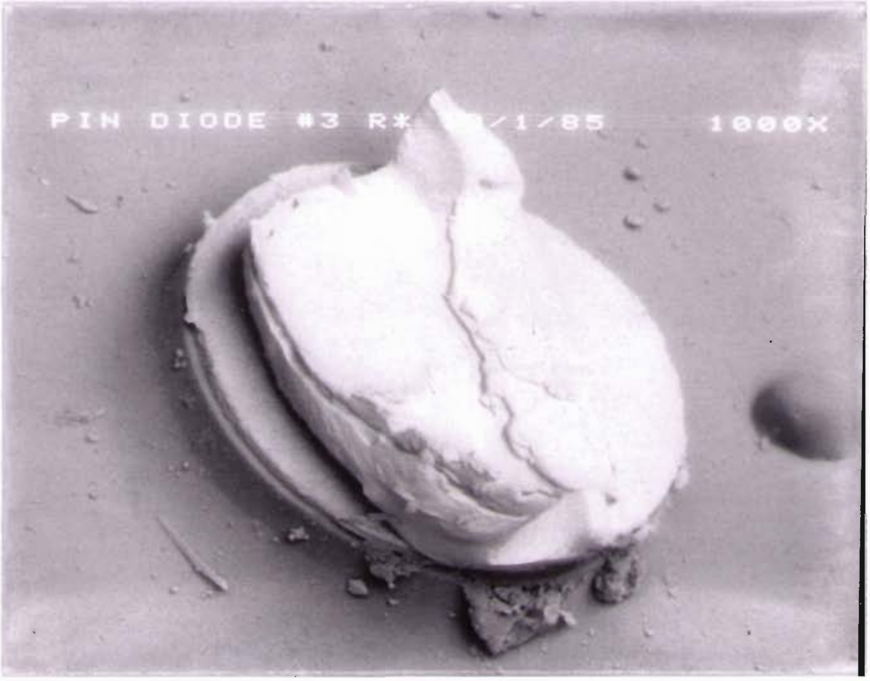


Fig 9

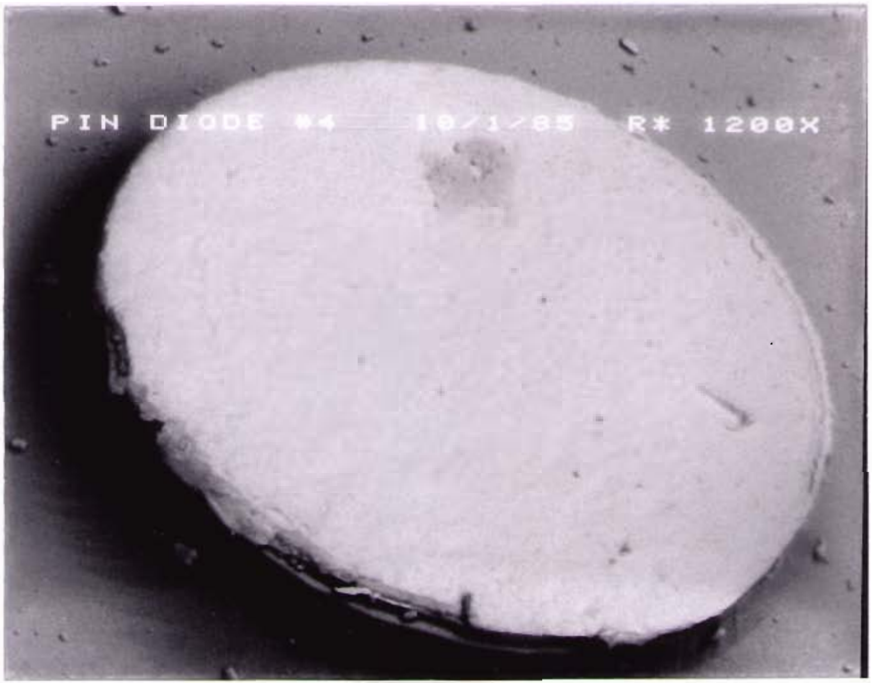


Fig 10a

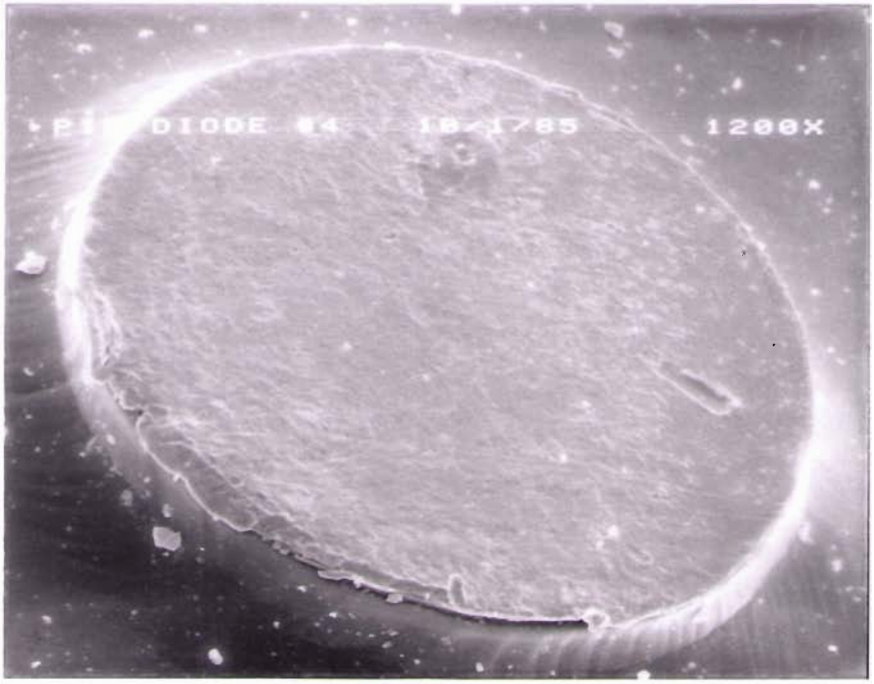


Fig 10b

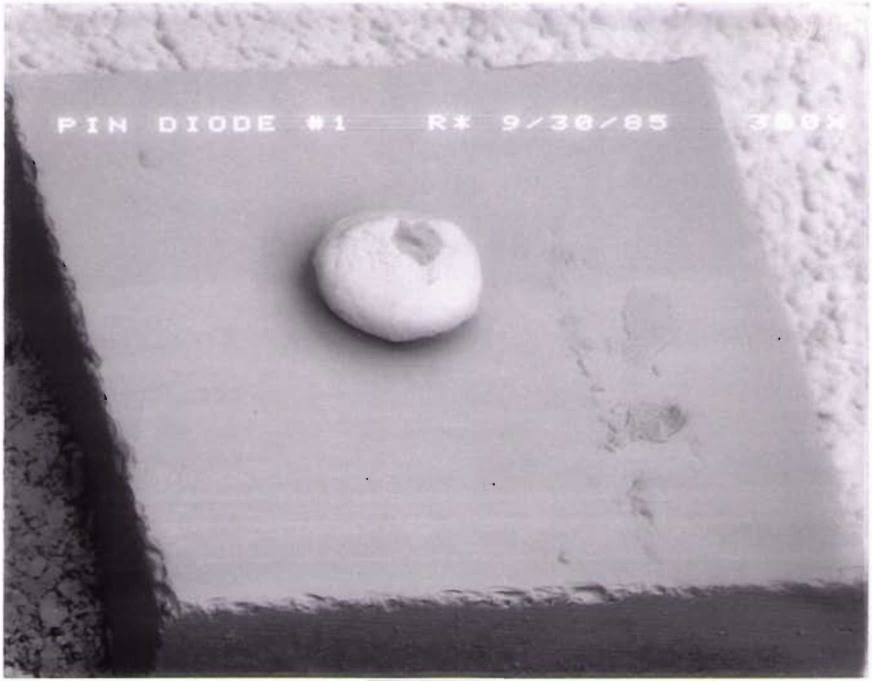


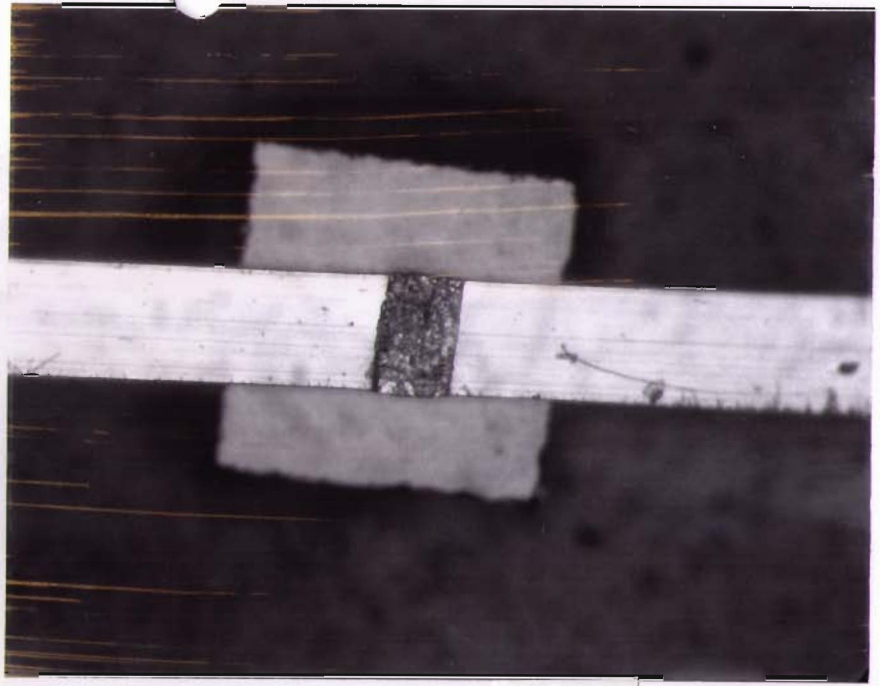
Fig 11a

Fig 11b

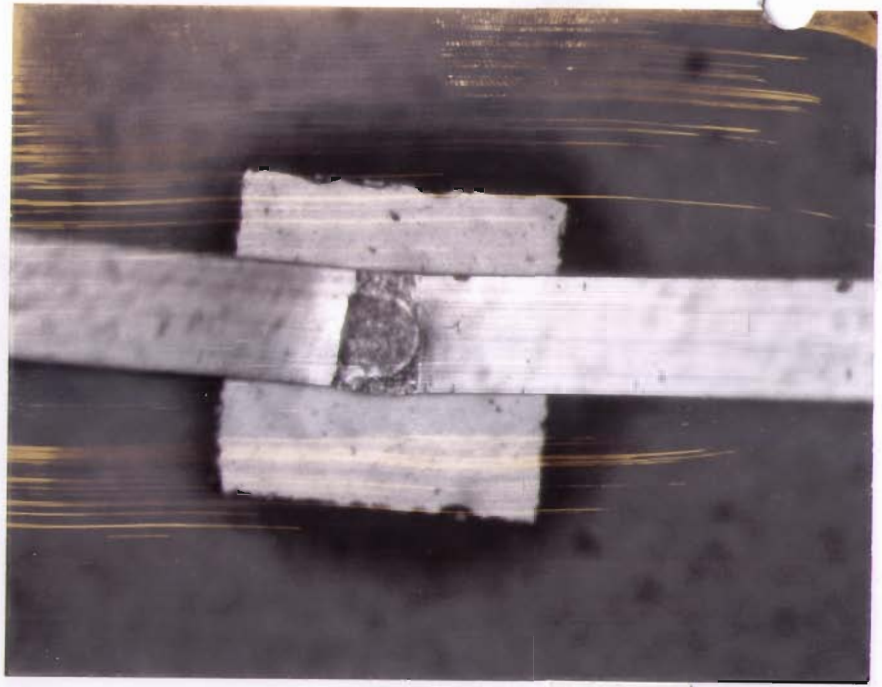
VISUAL INSPECTION CORRELATION

PHOTO	PULL STRENGTH (GRAMS)	POINT OF BREAK
12b, 12r	6.5	DIE
12c, 12s	14.1	SUBSTRATE
12d, 12t	13.5	SUBSTRATE
12e, 12u	13.4	SIMULTANEOUS
12f, 12v	6.9	SUBSTRATE
12g, 12w	6.5	DIE
12h, 12x	12.7	SIMULTANEOUS
12i, 12y	1.1	DURING ATTACH
12j, 12z	14.7	SIMULTANEOUS
12k, 12aa	17.2	DIE
12l, 12bb	11.4	SIMULTANEOUS
12m, 12cc	7.6	SIMULTANEOUS
12n, 12dd	11.1	DIE
12o, 12ee	11.3	DIE
12p, 12ff	11	SIMULTANEOUS
12q, 12gg	5.4	DIE

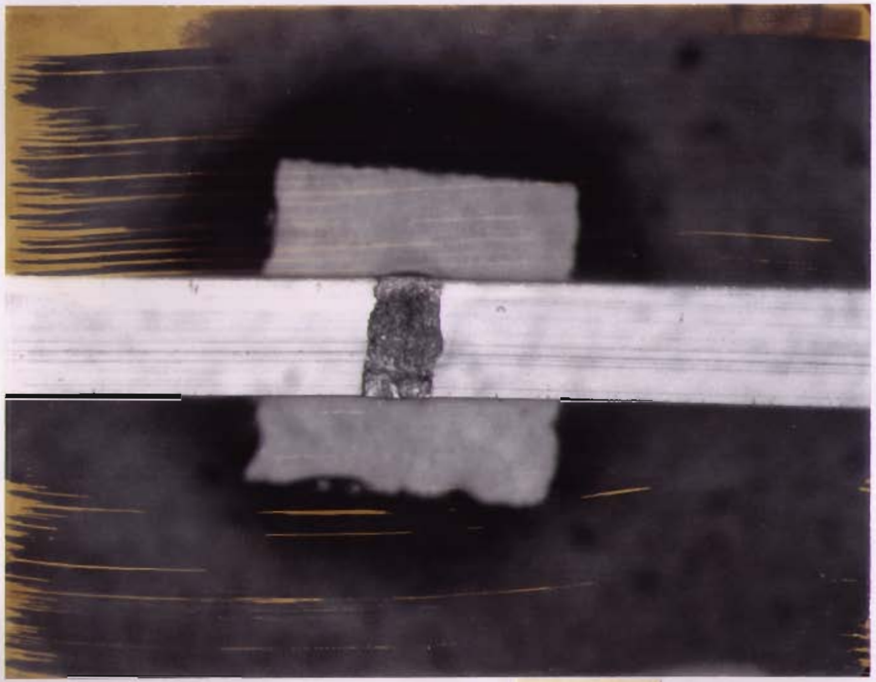
Fig 12a



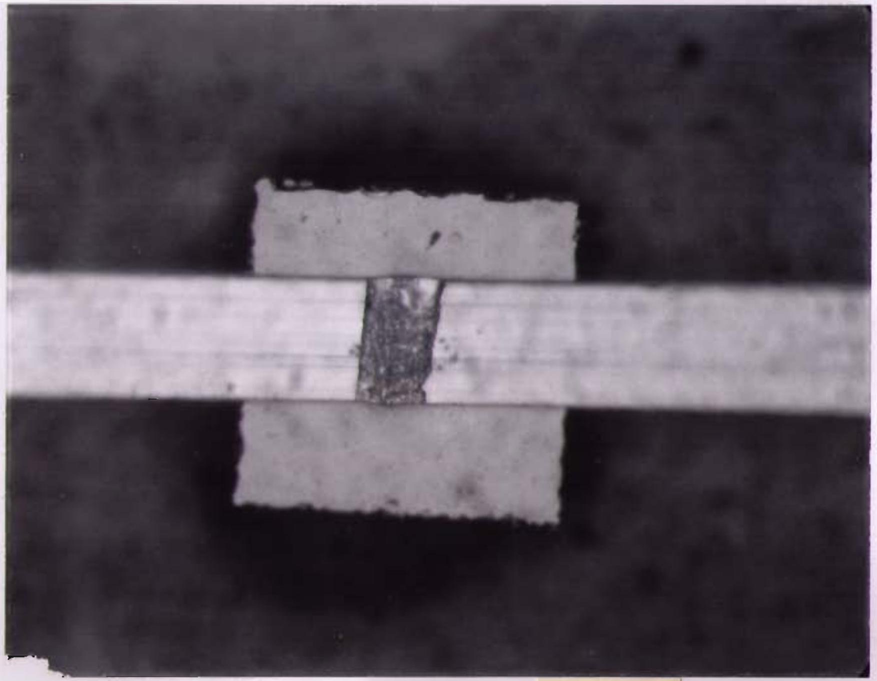
1 Fig 12b



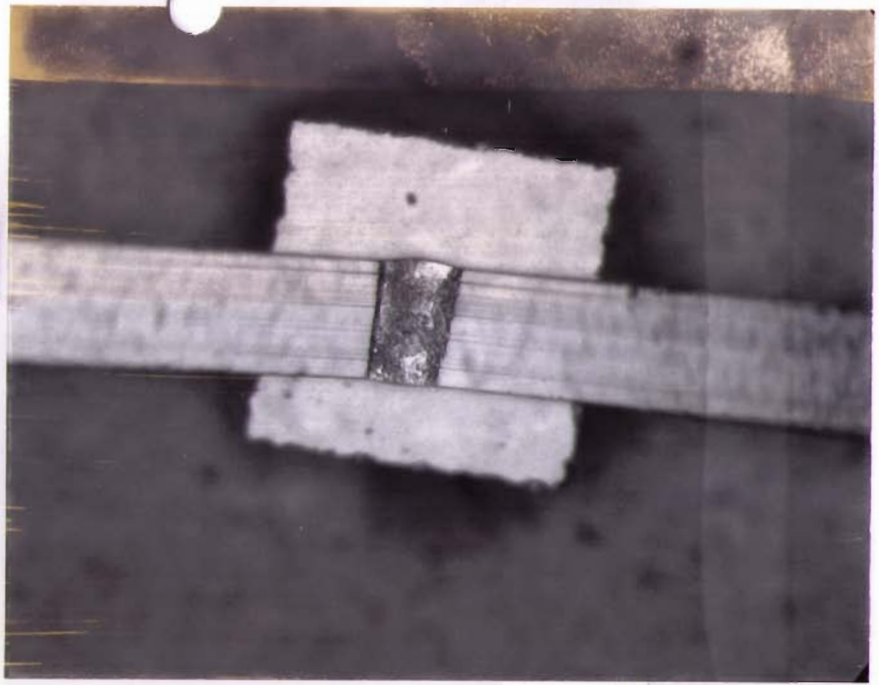
2 Fig 12c



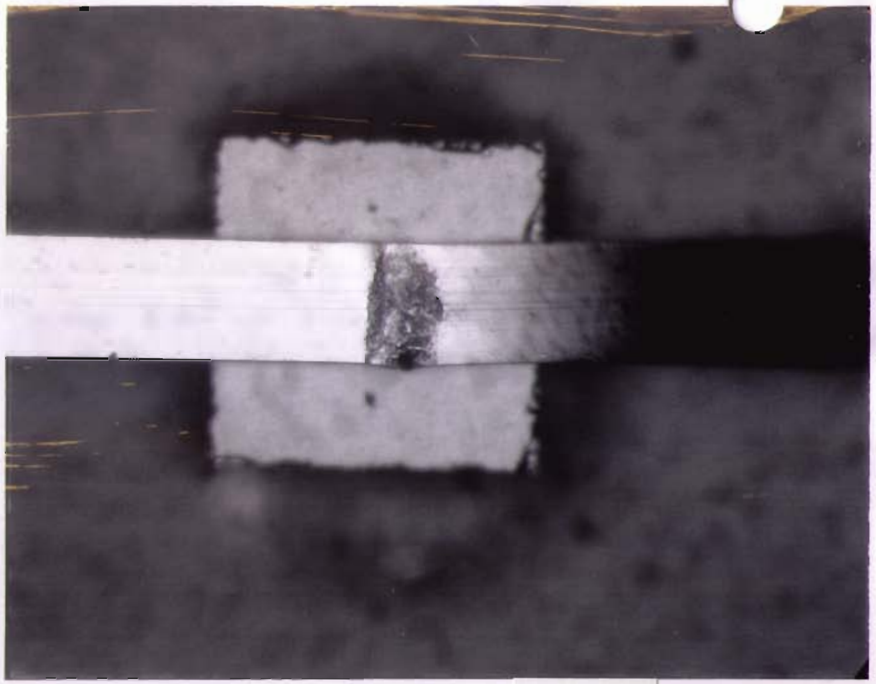
3 Fig 12d



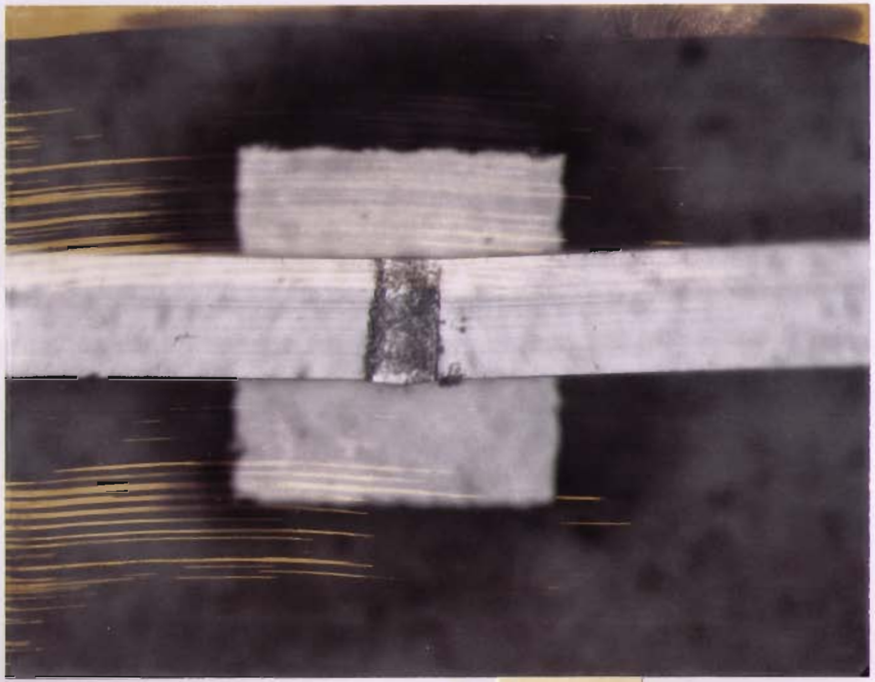
4 Fig 12e



5 Fig 12f



6 Fig 12g



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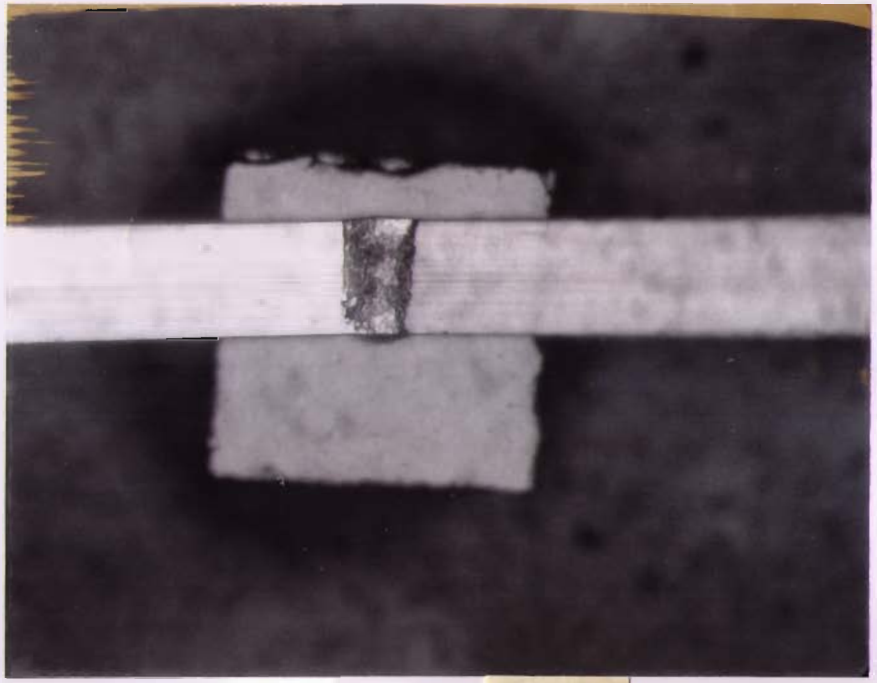
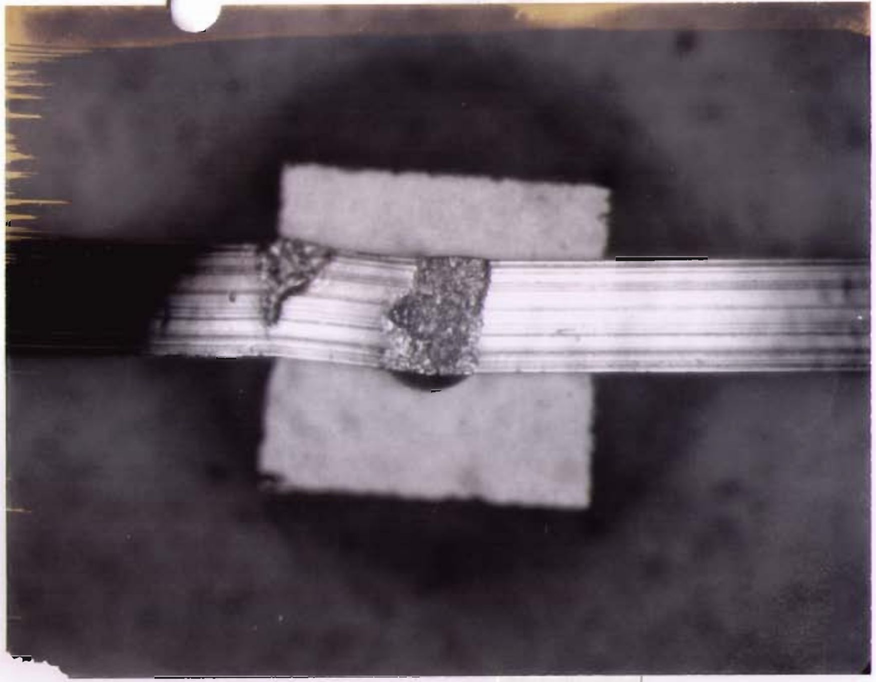
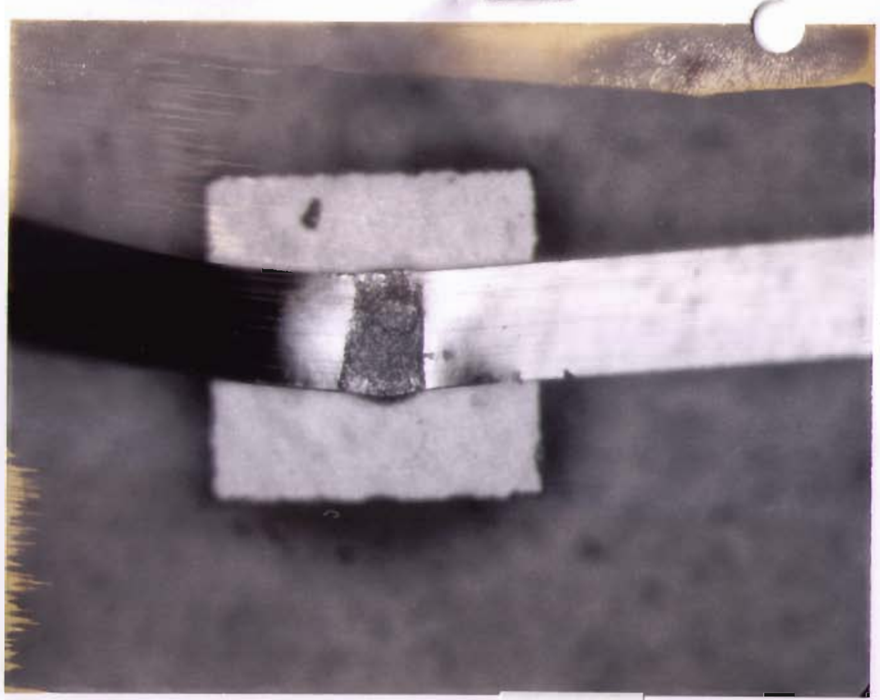


8 Fig 12i



9 Fig 12j



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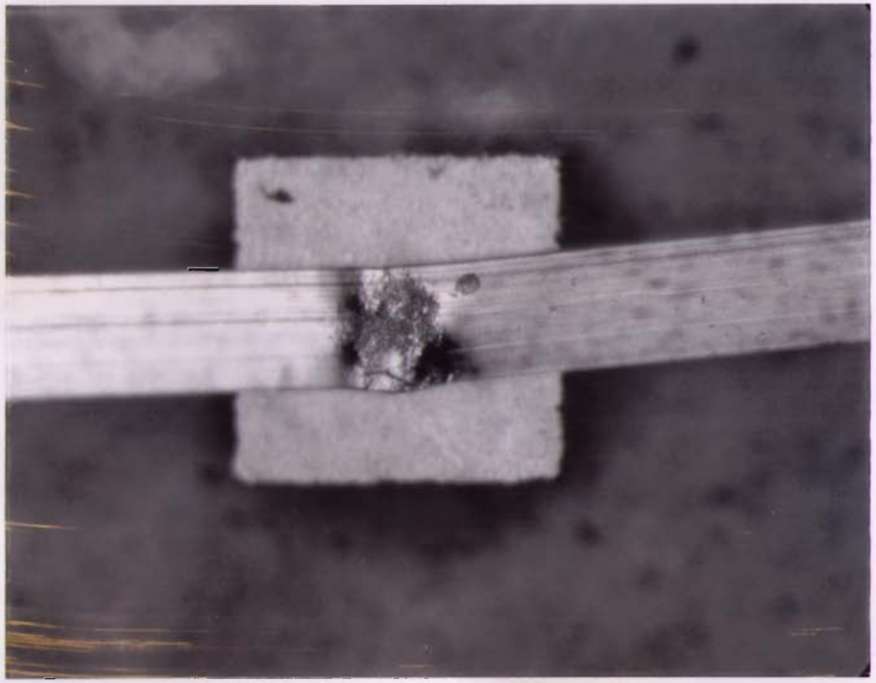
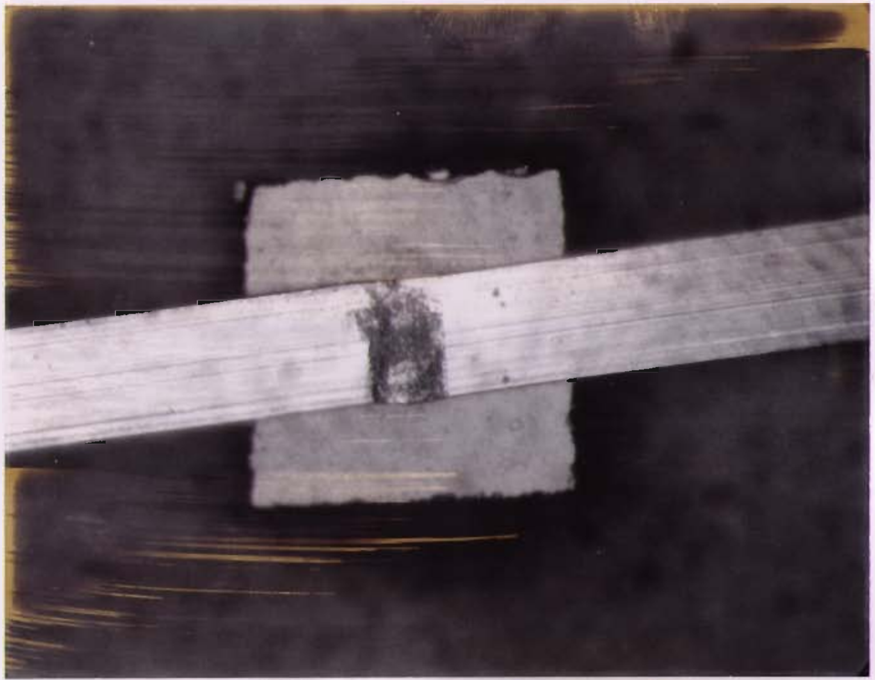
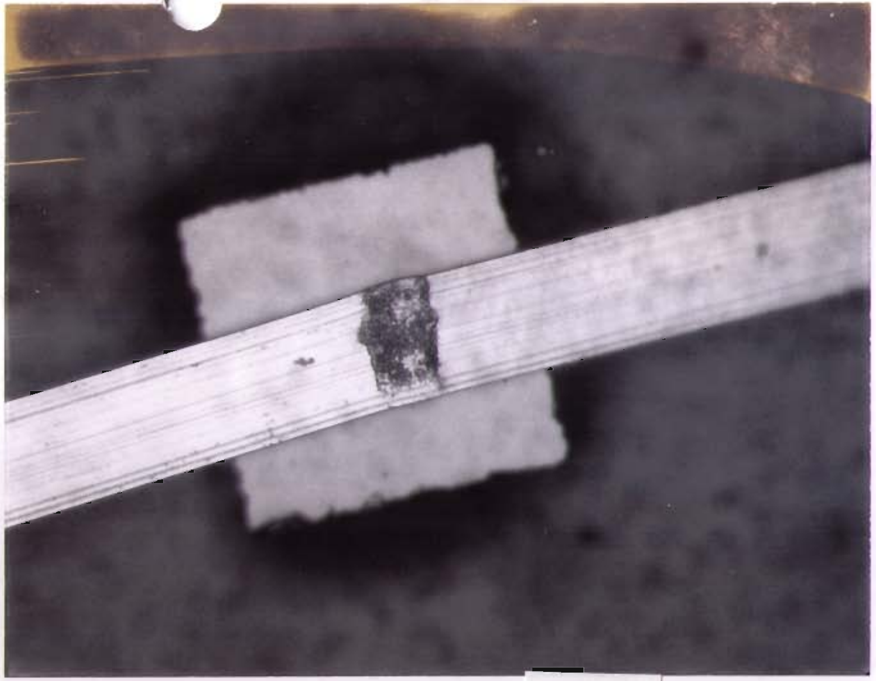


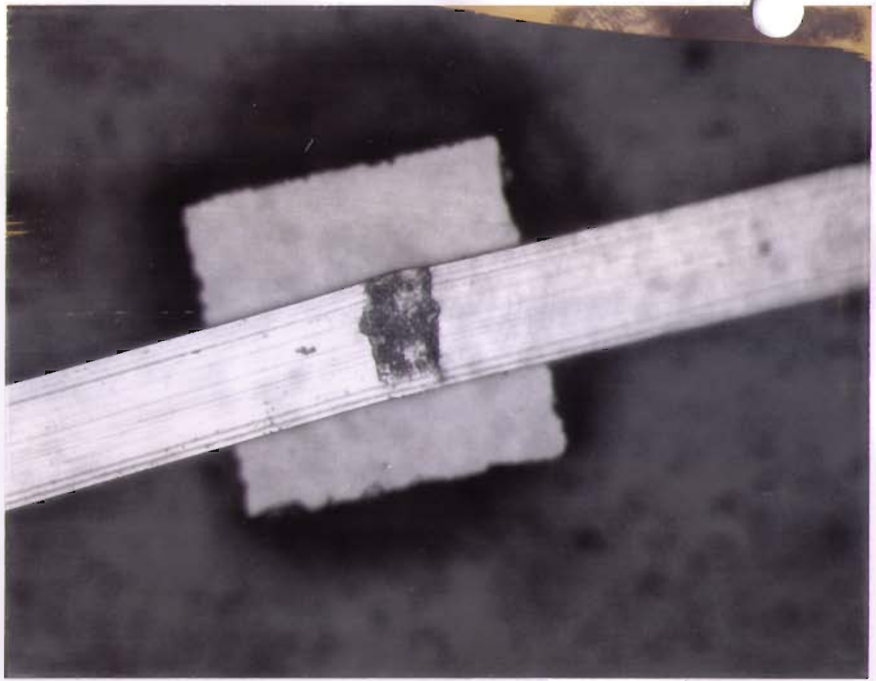
11 Fig 12l



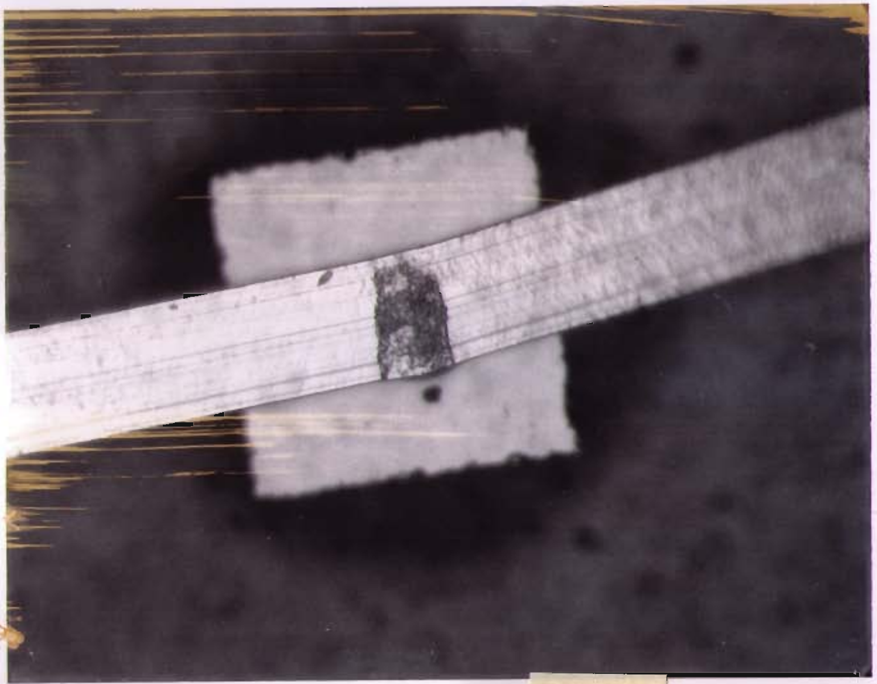
12 Fig 12m



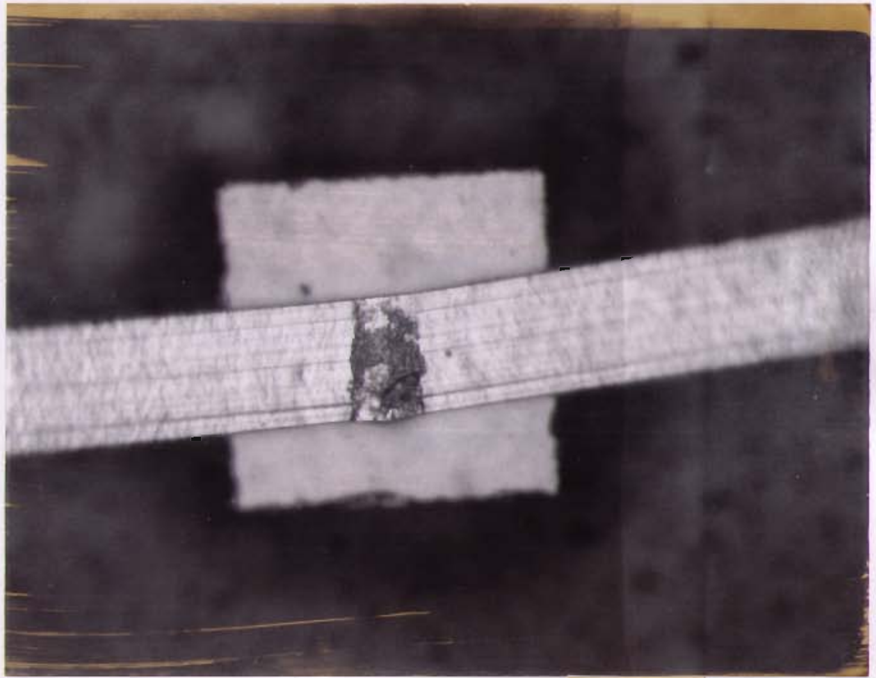
13 Fig 12n



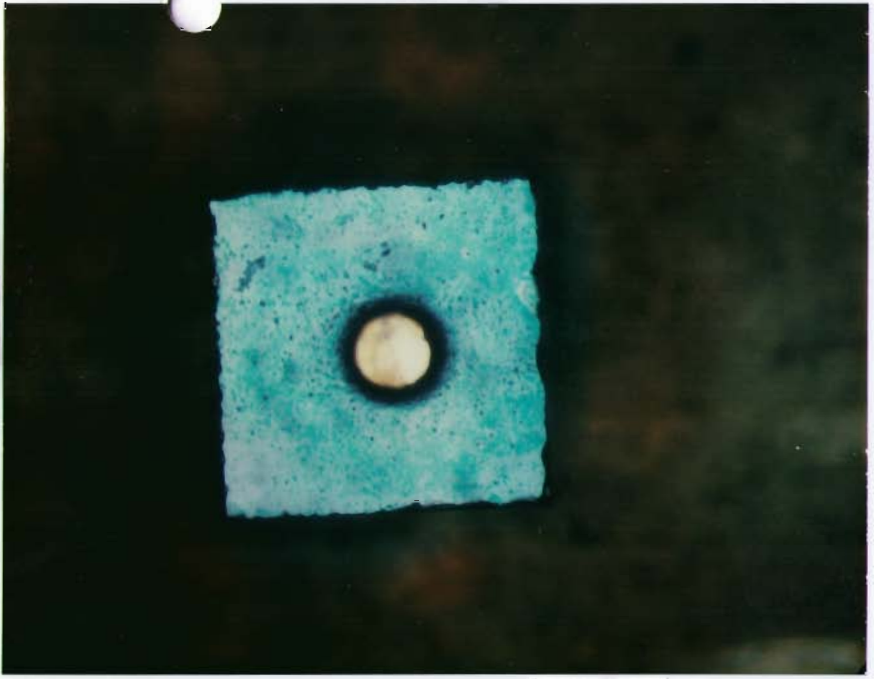
14 Fig 12o



15 Fig 12p



16 Fig 12q



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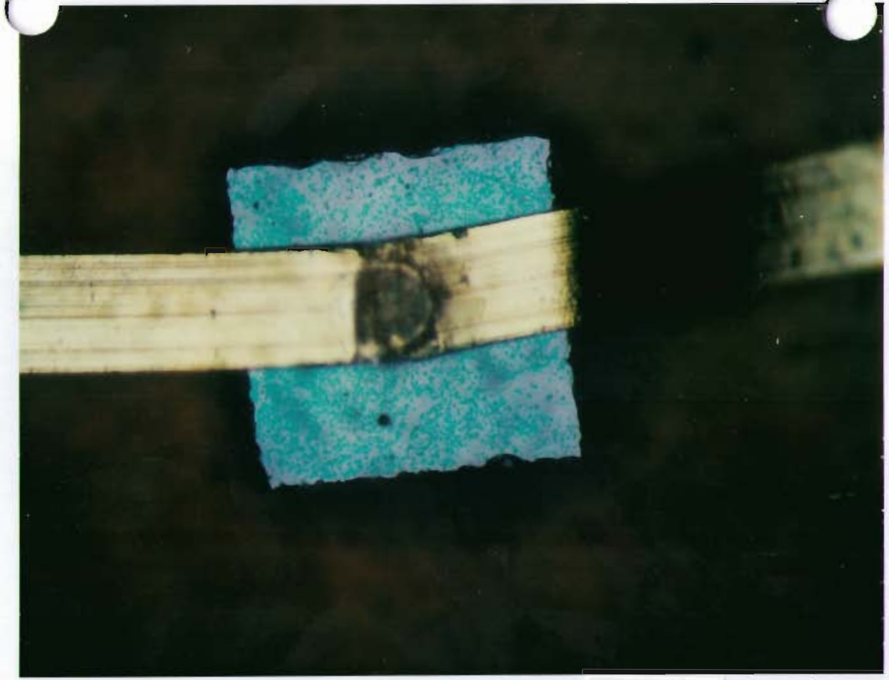
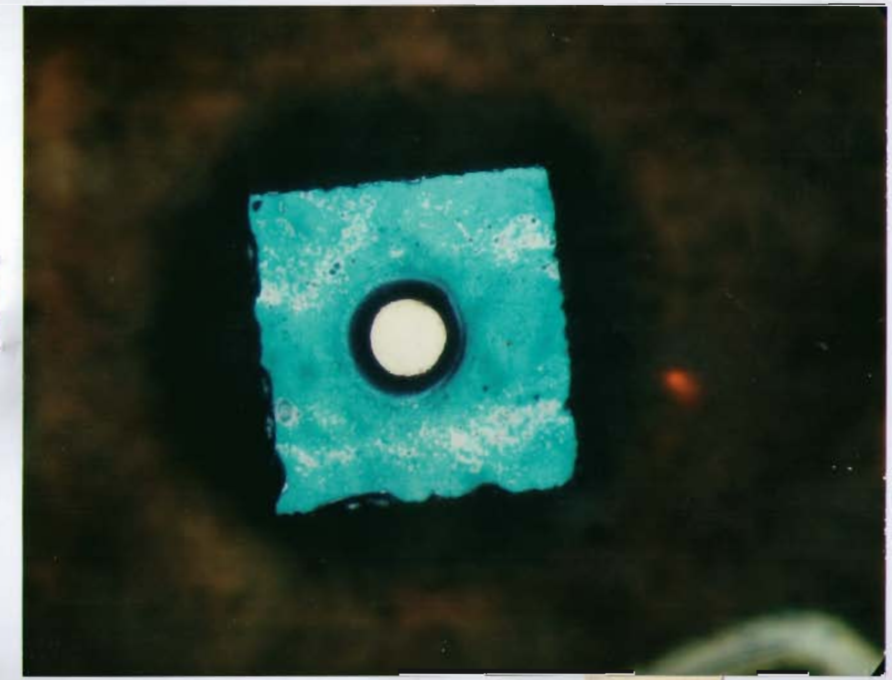


2 Fig 12s



3 Fig 12t

4 Fig 12u

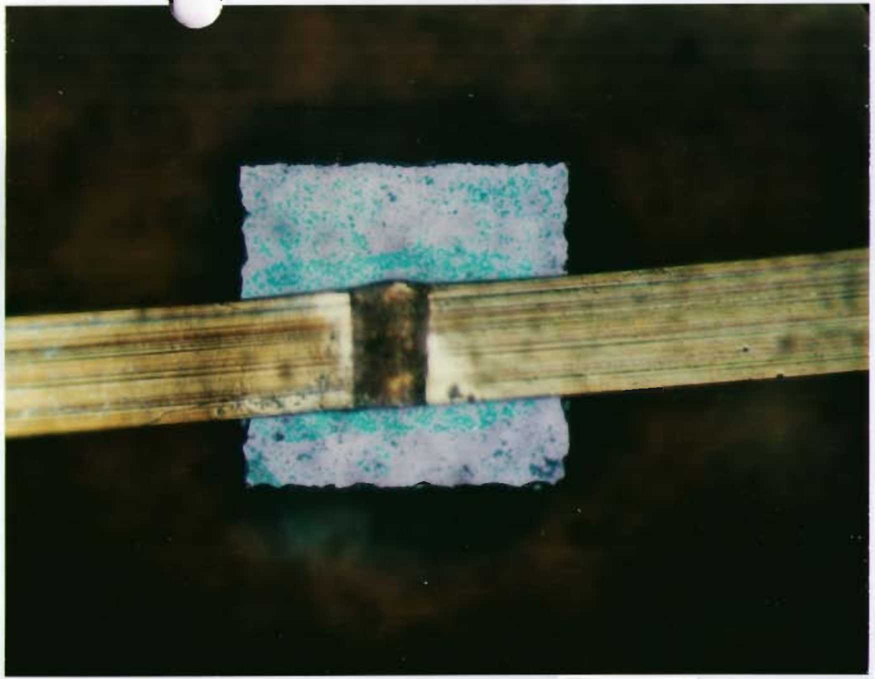


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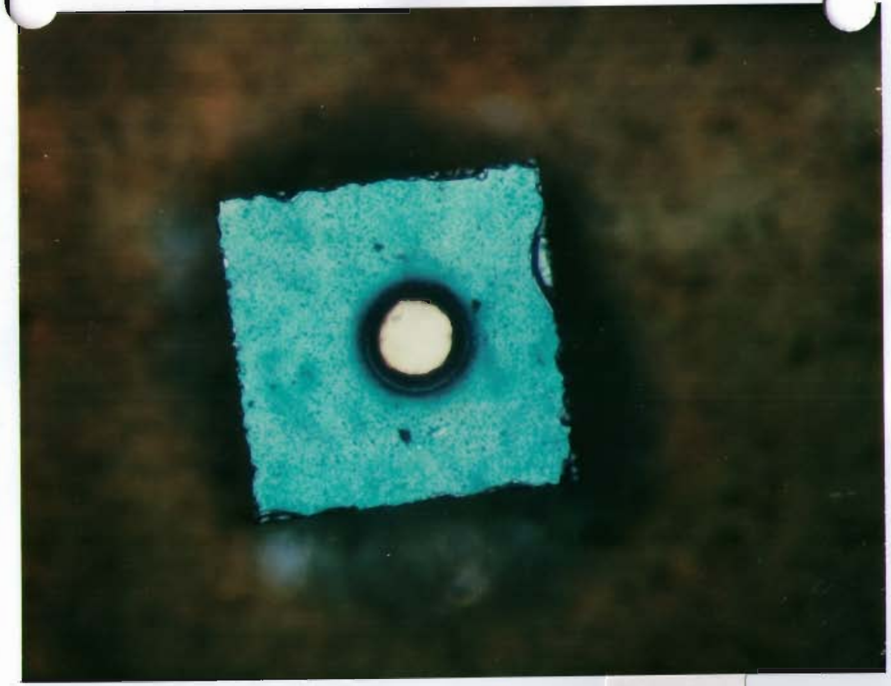
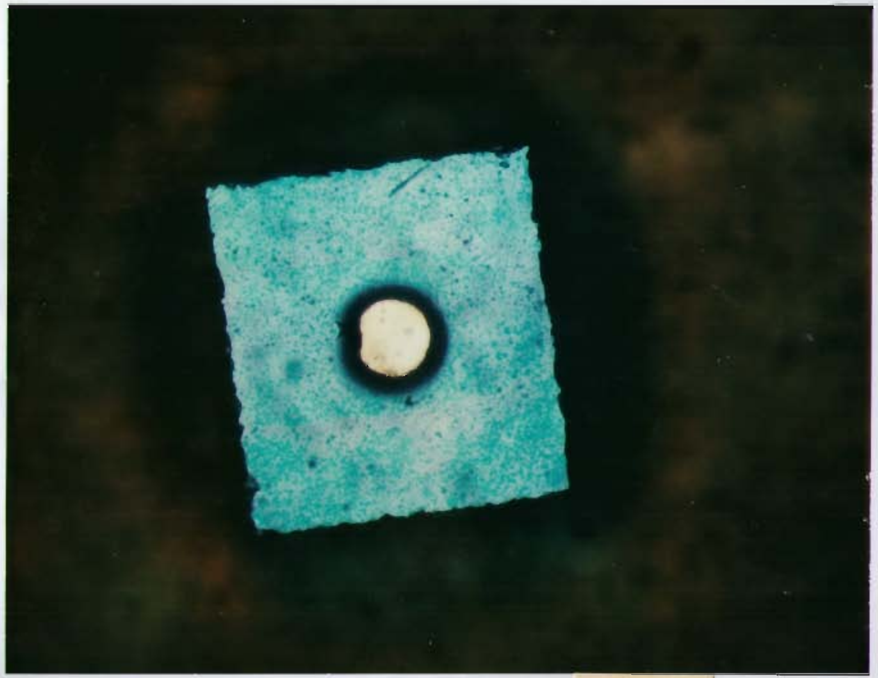
Fig 12v



6

Fig 12w

LOT 19



7

Fig 12x

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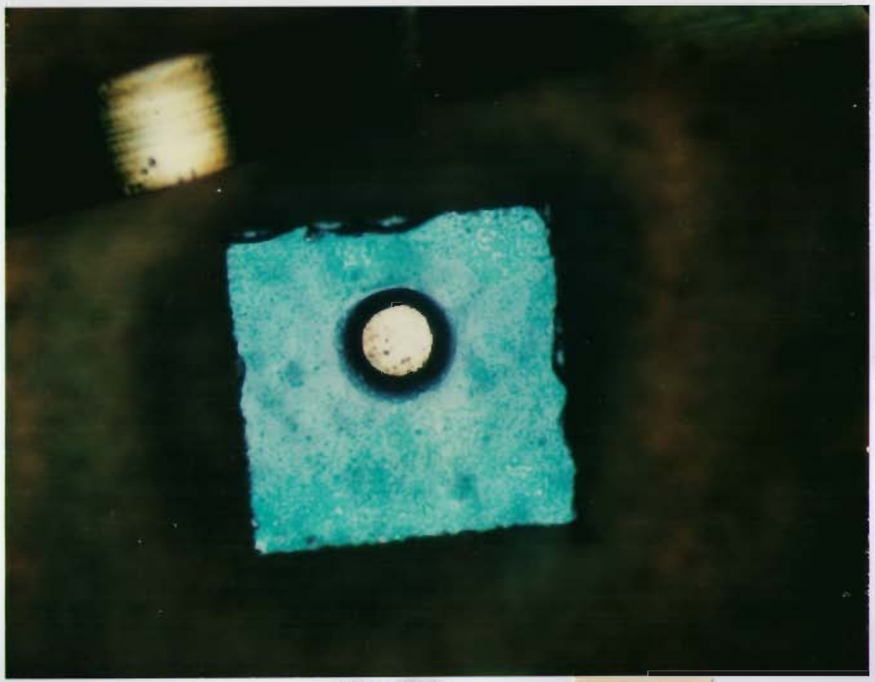

8

Fig 12y

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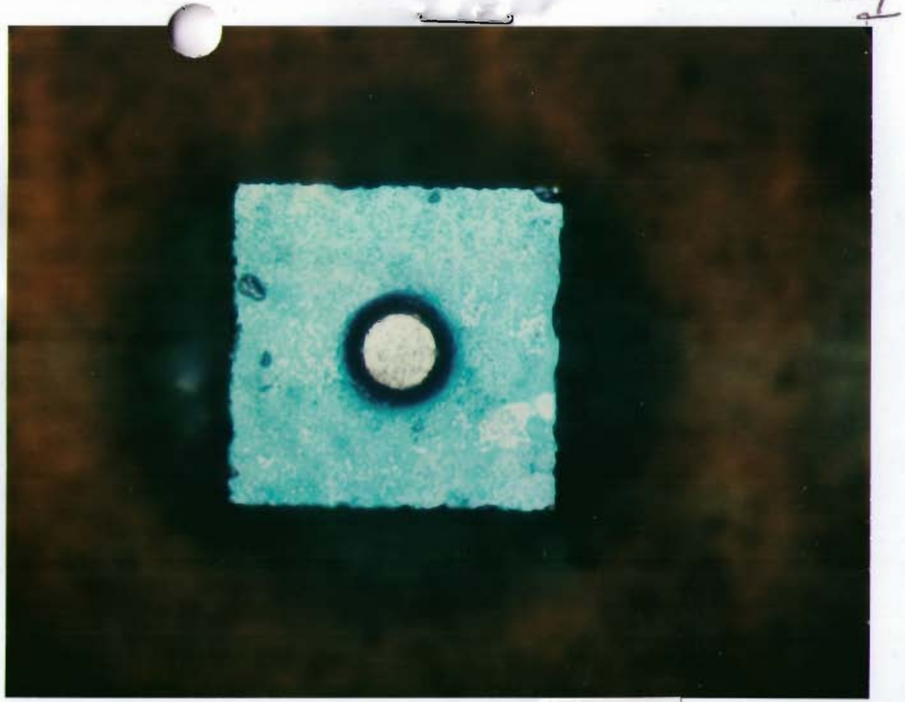
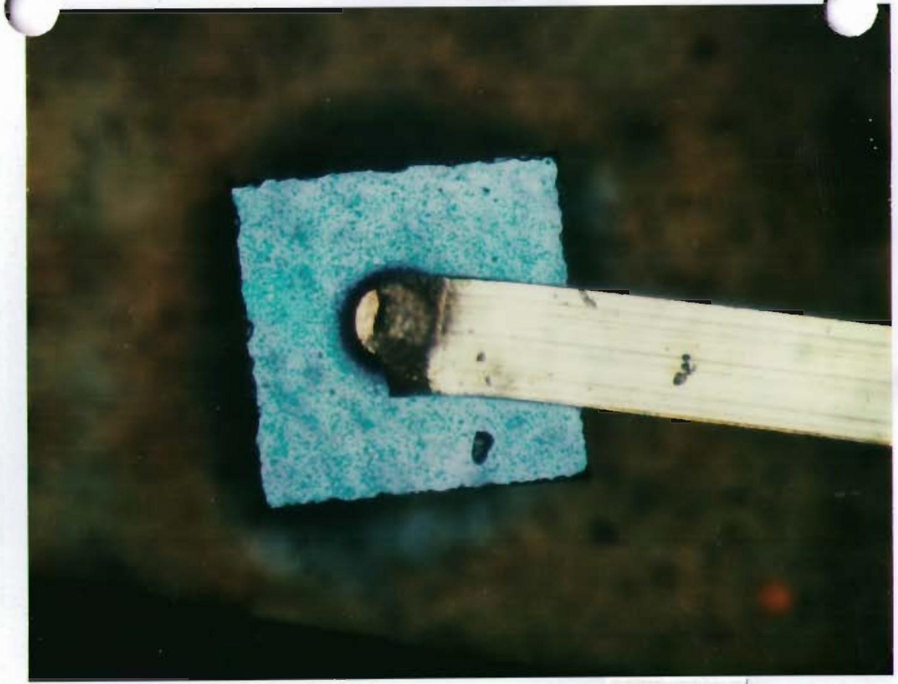
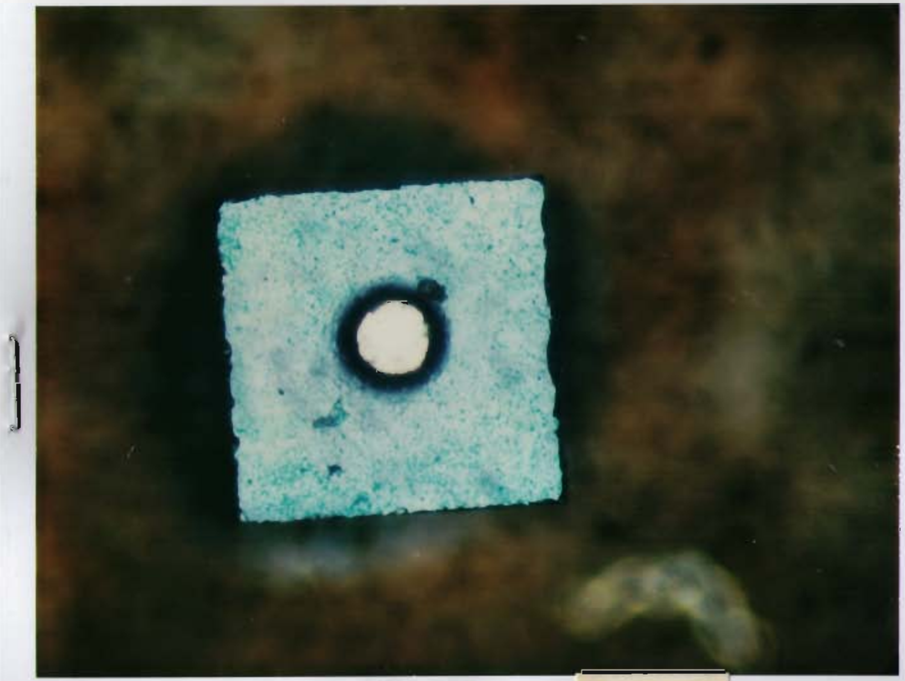


9 Fig 12z



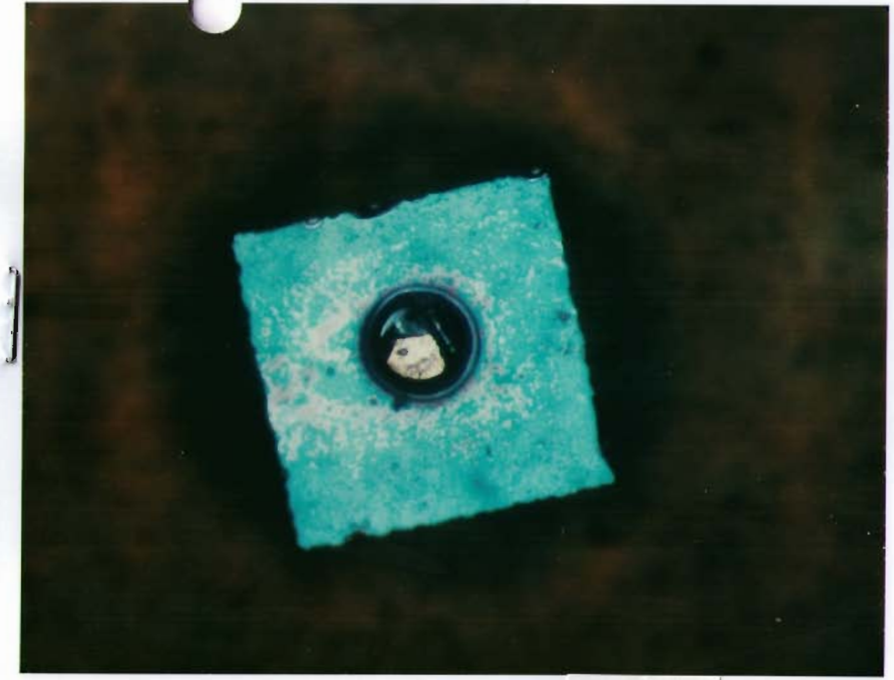
10 Fig 12aa

Lot 27

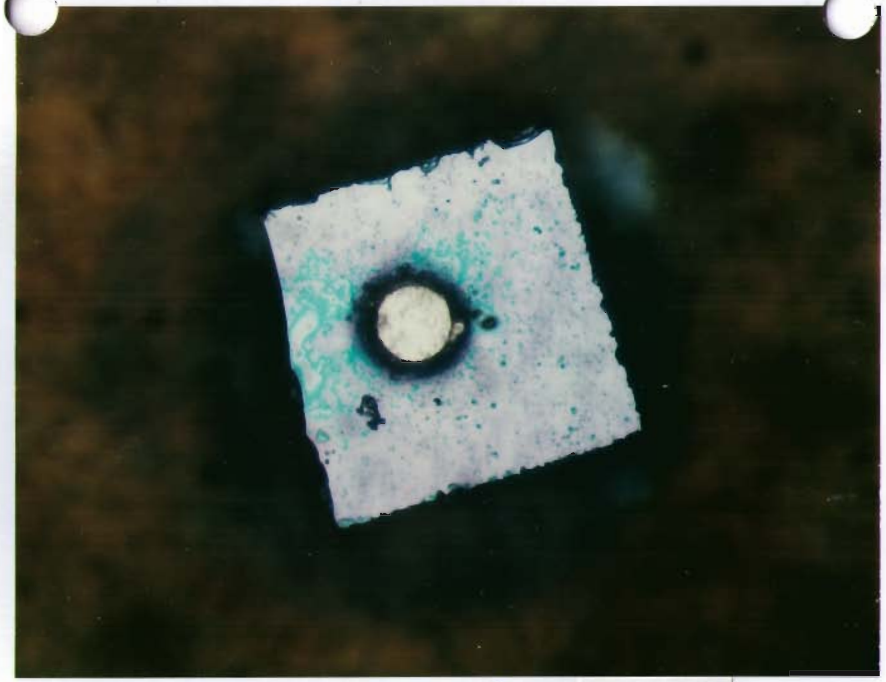


11 Fig 12bb

12 Fig 12cc

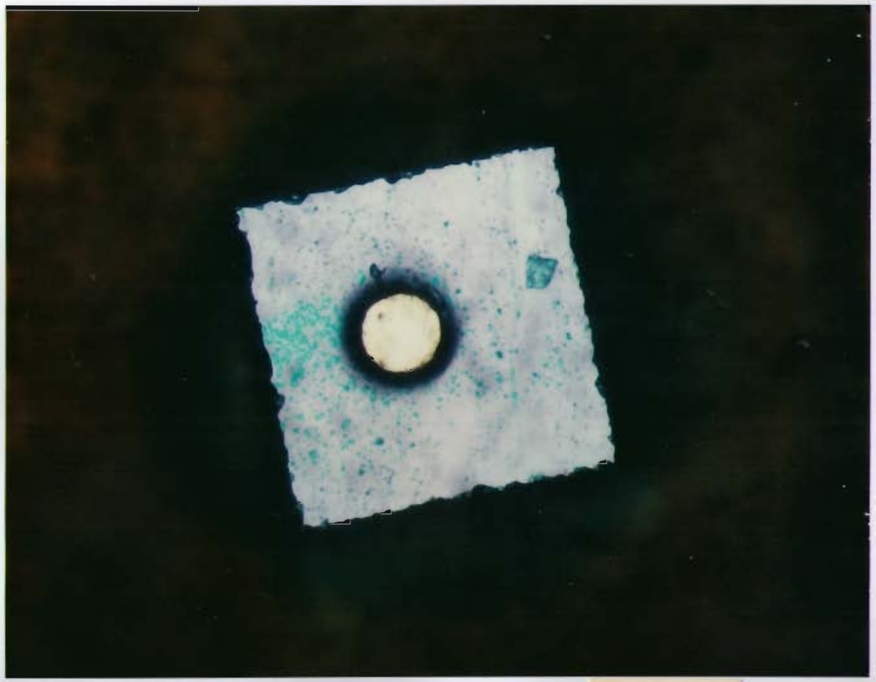


13 Fig 12dd

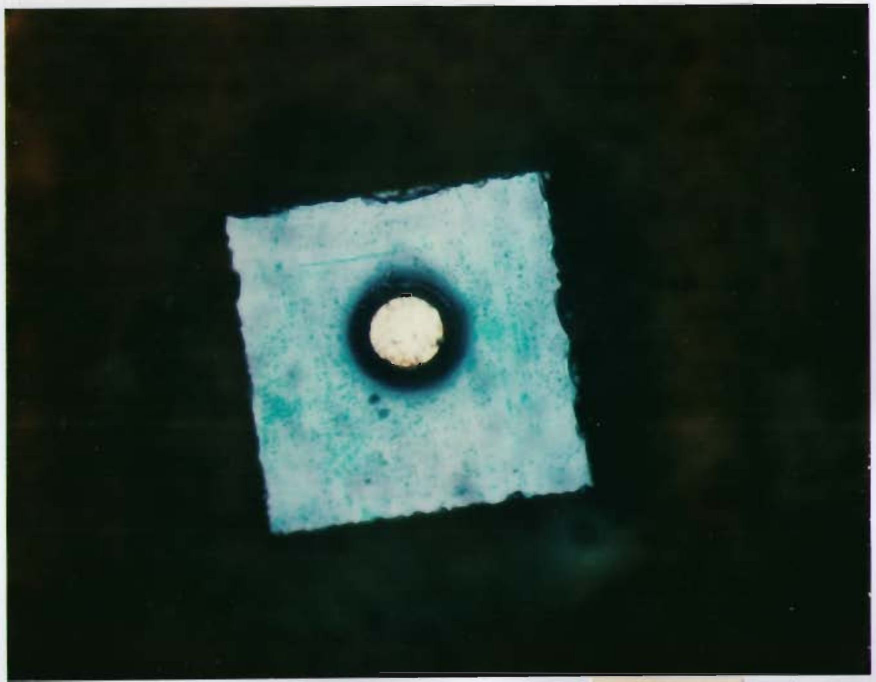


14 Fig 12ee

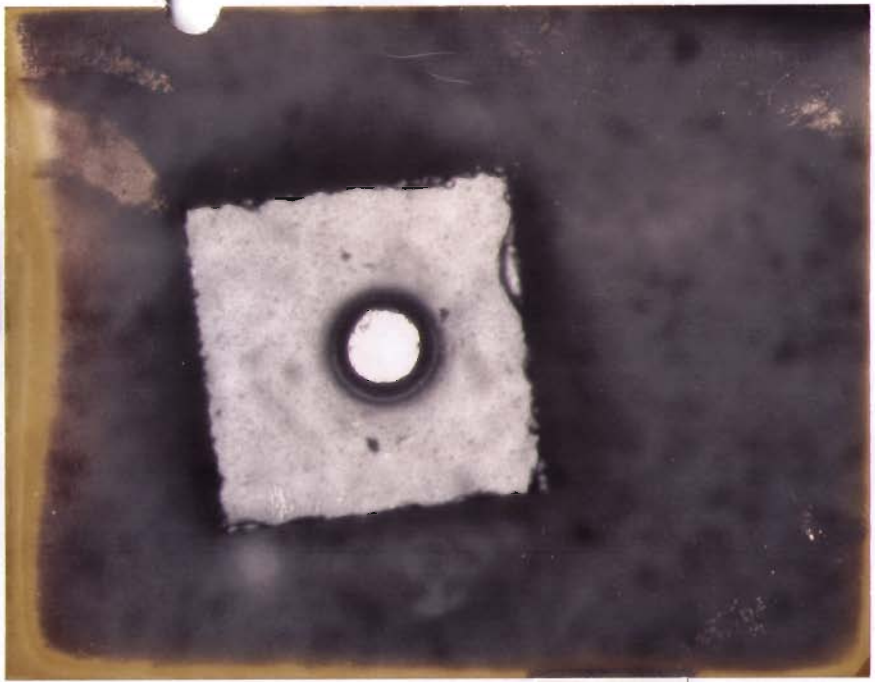
LOT 23



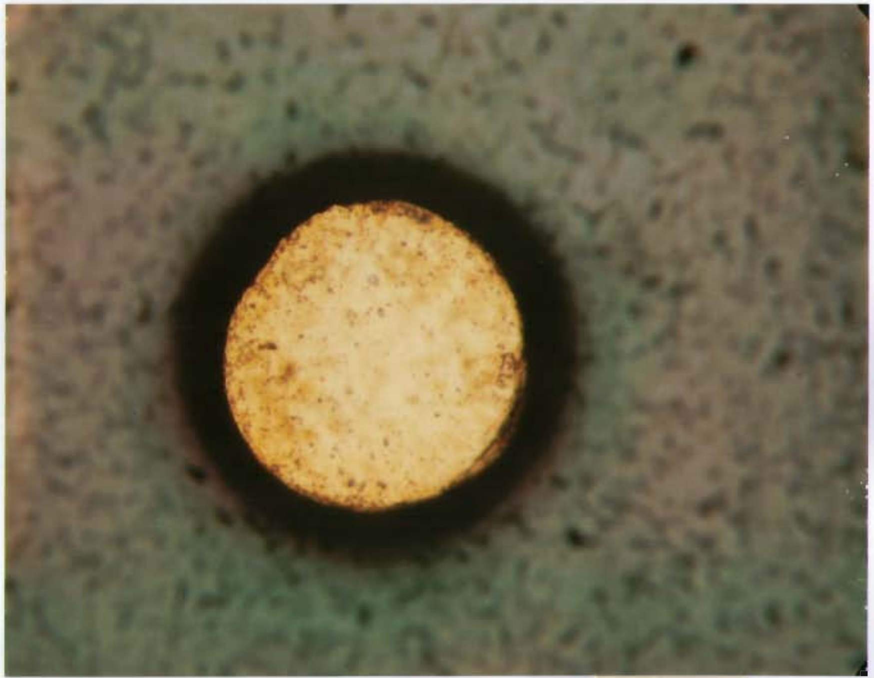
15 Fig 12ff



16 Fig 12gg



6 Fig 12hh



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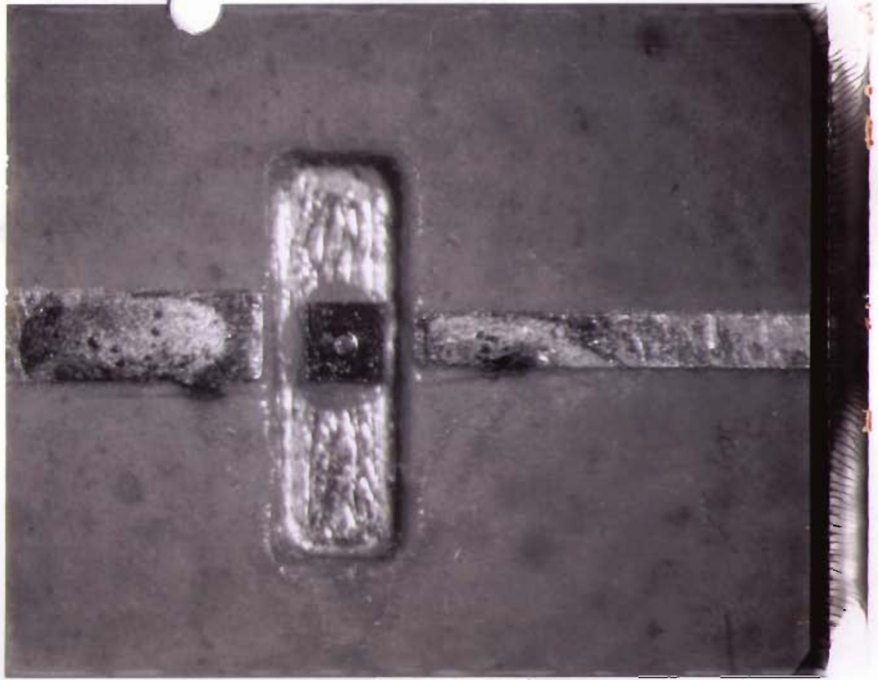


Fig 13a

10

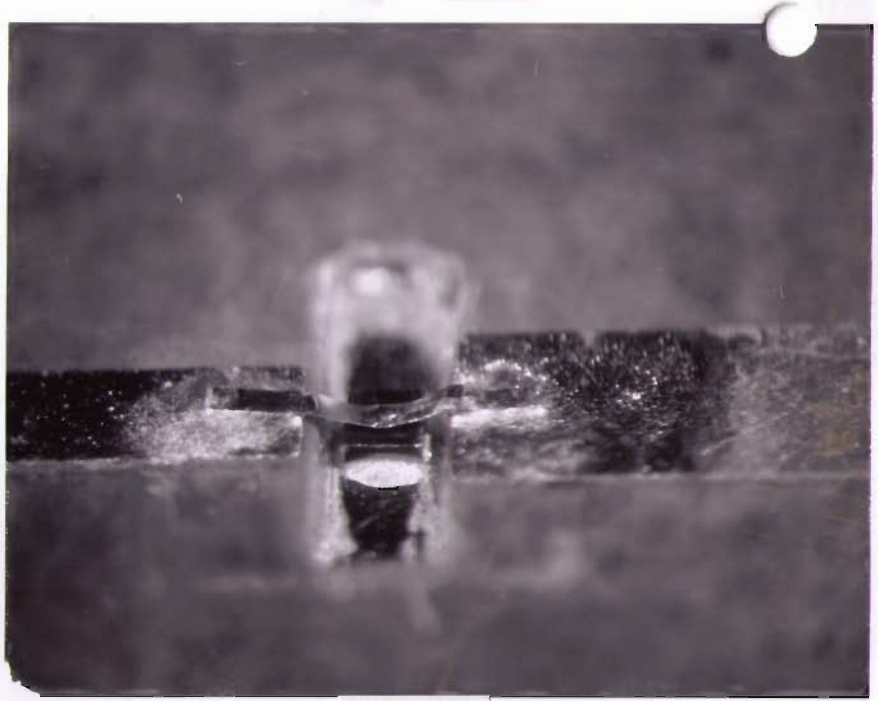


Fig 13b

4

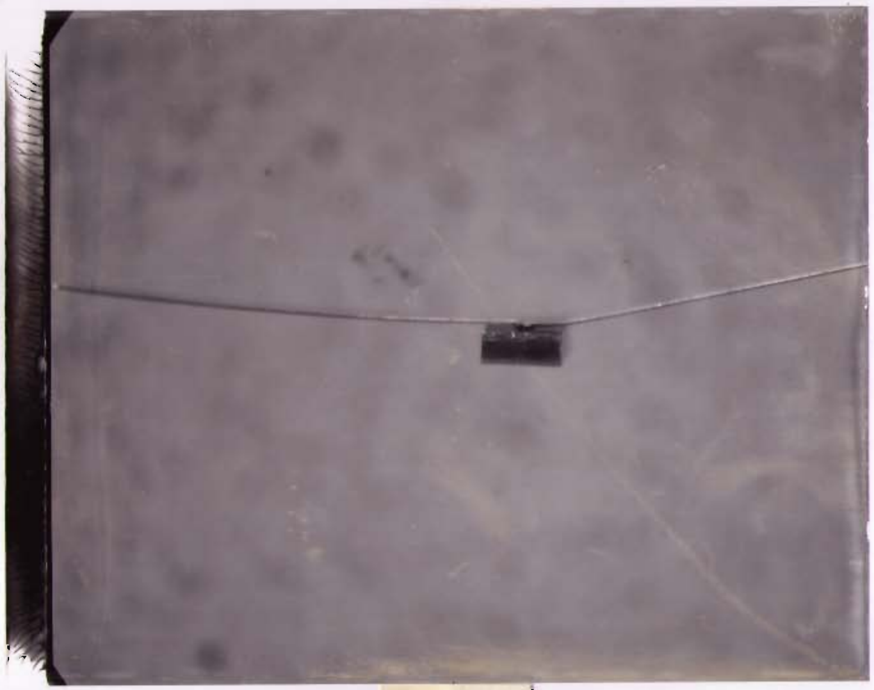


Fig 13c

11

Fig 13d

7

AMECOM

MANUFACTURING
PROCESS
PROCEDURE

ORIG.	PROCEDURE NO. MPP 7301	
APPR. IE 5/15/86	DATE OF ISSUE 3/21/86	REVISION -
APPR. MFG.		
APPR. Q.A.	PAGE 1 OF 8	

TITLE

WIREBONDING TO ALUMINA CIRCUITS

Litton Proprietary

1.0 SCOPE

1.1 This process procedure details the equipment, set-up, and bonding procedure for applying 1.0 and .7 mil gold wire to alumina circuits. Included will be circuit to circuit interconnects as well as circuit to device and device to device interconnect techniques.

2.0 SAFETY

2.1 Stages and transducers are hot, do not touch at any time during processing.

3.0 REFERENCE DOCUMENTS

3.1 Military

3.1.1 MIL-C-38510 Electronic Warfare

3.1.2 MIL-STD-883 Test Procedures for Electronic Hardware

3.2 Amecom

3.2.1 Workmanship Standards

4.0 MATERIALS

4.1 Gold wire 99.999% pure
.0007 and .001 inch diameter Amecom PT #900407
1-3% elongation

4.2 Wedges and Capillaries - See Table 1

5.0 EQUIPMENT

5.1 Mech-El 907 Thermosonic Wedge Bonder (or equivalent) with generator.

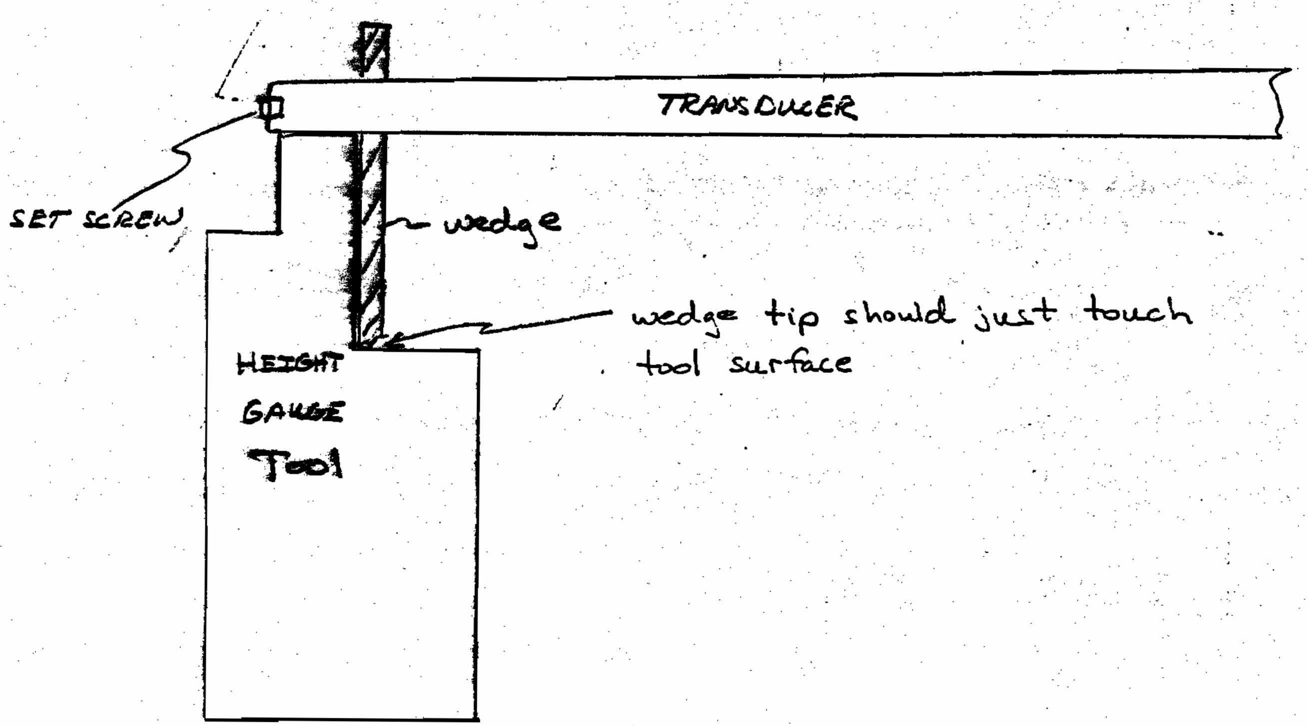
5.2 Mech-El 901 Thermosonic Wedge Bonder with 20E generator (or equivalent.

5.3 Kulicke & Soffa 4123 Thermosonic Ball Bonder or equivalent

5.4 Kulicke & Soffa 4124 Thermosonic Wedge Bonder or equivalent

5.5 Mech-El 829Z Ball Bonder or equivalent

SUBJECT
WIREBONDING TO ALUMINA CIRCUITS



wedge tip should just touch tool surface

FIG. 1

.0 SET-UP

6.1 Mech-El 907 and 901, Westbond, and K & S 4124.

6.1.1 Insert wedge (cross groove or concave) into the transducer and tighten the set screw. Using the height gauge fixture, lower the wedge onto the fixture. Adjust the wedge as required until transducer horn touches the top of the fixture. Tighten set screw (See Figure 1).

6.1.2 Press the "test" button on the ultrasonic generator. The red LED should go to green as long as the button is depressed. If the green LED does not light, contact a manufacturing engineer. DO NOT ATTEMPT TO BOND.

6.1.3 Place a spool of the required size gold wire onto the bobbin. Thread the wire through the transducer (if applicable) and through the clamp-wedge assembly.

6.1.4 Set stage height. For Mech-El 907 and 901 the stage height should be 2.5 inches from the workstation base to the surface to be bonded. For the K&S 4124 stage height should be 3.0 inches. Westbond height should be set at 2.5 inches. Mech-El 829Z stage height is 2.8 inches.

NOTE: These settings are for flat substrates. If bonding is performed inside housings etc. the stage height must be adjusted.

6.2 K & S 4123 ball bonder

6.2.1 Insert a ceramic capillary into the transducer. Bring the capillary up through the transducer until it is flush with the top surface of the transducer and tighten the set screw.

6.2.2 Place spool of proper size wire onto the spool mount. Thread wire thru glass core toward tensioner.

6.2.3 Feed wire off the spool and through the tensioner (note: wire must go under glass plate), through the 1st clamp, the eyelet, 2nd clamp, and into the capillary.

6.2.4 Depress the EFO button (EFO S/B 9) to form a ball on the wire.

6.2.5 Set stage height to 3.0 inches. Stage temperature should be 125°C ± 10.

6.3 Mech-El 829Z Ball Bonder

6.3.1 Insert a ceramic capillary into the transducer. Bring the capillary up through the transducer until it is flush with the top surface of the transducer and tighten the set screw.

6.3.2 Place a spool of wire onto the wire mount. Feed the wire over the tensioner, through the clamps (between dark pad and silver pad), and through the capillary.

6.3.3 Pull enough wire through the capillary (approximately 1.0 inch) to bond off and form a ball.

6.3.4 Set stage height to 2.8 inches. Stage temperature should be 125°C (250 setting) and tip temperature should be set on 2.5.

6.4 Parameter Selection - Thermosonic Wedge Equipment

6.4.1 Force - the force with which the wedge contacts the surface is regulated by weights internal to the machines. These weights have been pre-set to provide approximately 27-30 grams of force.

6.4.2 Temperature - set temperature to 125°C ± 10 . (Note: on the Mech-El bonders 125°C equals a setting of 250 units.)

6.4.3 Time-Power - these parameters are critical to the bonding process. The following parameter sets are given as recommended starting points. Day to day differences in circuit age, contamination, wire etc. may require slight deviations. Note that all bonds must meet the requirements of Amecom workmanship standards and the applicable military specifications.

Mech El 907	Power 1 = 3.5	Time 1 = 3.0
	Power 2 = 3.5	Time 2 = 3.0
Mech El 901	Power 1 = 5.0	Time 1 = 3.0
	Power 2 = 5.0	Time 2 = 3.0
K & S 4124	Power 1 = TBD	Time 1 = TBD
	Power 2 = TBD	Time 2 = TBD
Mech-El 829Z	Power 1 = TBD	Time 1 = TBD
	Power 2 = TBD	Time 2 = TBD

6.5 Parameter Selection - Thermocompression Wedge Equipment

6.5.1 Force - this has been pre-set to approximately 27-30 grams.

6.5.2 Temperature - The wedge should be heated to 150°C ± 10.
- The stage should be heated to 150°C ± 10.

6.5.3 Time - Time is not adjustable on this equipment. Bonding occurs due to the force temperature. The user is cautioned however not to hold the wedge in firm contact with the surface for more than 1 second as severe wire deformation may result.

6.6 Parameter Selection Thermosonic Ball Bonder Equipment

6.6.1 Force - two force settings are required. The first is used to adhere the gold ball to the surface. The second to perform a wedge type bond and breaks the wire to allow for subsequent ball formation. These parameters are coarsely set at:

ball force = 30 grams
wedge force = 60 grams

These settings may be slightly adjusted via the front panel knobs. Adjustment shall only be required to overcome inconsistencies in the circuit.

6.6.2 Temperature - stage temperature should be set at 125°C ± 10.

6.6.3 Power - time - these parameters are critical to the bonding process. The following parameter set is given as a recommended starting point. Inconsistencies in wire age circuit bondability etc. may require these settings to be adjusted. Note that all bonds must meet the requirements of Amecom workmanship standards and the applicable military specifications.

Power 1 = 4.0	Time 1 = 3.5	Force = 4.5
Power 2 = 4.0	Time 2 = 4.0	Force = 5.0

6.7 GENERAL REQUIREMENTS

6.7.1 All circuits shall be stored in dry nitrogen.

6.7.2 All bonded circuits shall be handled with tweezers only. Finger cots shall be worn when handling the ceramic prior to bonding.

6.7.3 All circuits shall be cleaned per (section 6.0) prior to bonding.

6.7.4 When bonding FETS - no ultrasonics may be used. Turn the power dial to zero. FET bonding shall use the following settings:

Power - 0	Power = 0	Force - TBD
Time - TBD	Time = TBD	Force - TBD

6.7.5 FETS shall be bonded in the following sequence only:

A. From circuit trace up to gate.
B. From circuit to source.
C. From circuit to drain.

6.7.6 Components shall be wirebonded by placing the first bond on the circuit, and the second bond on the device pad area.

6.7.7 When bonding couplers, take care that the tail does not short out between traces. When bonding from device to device, take care that the tail does not short to the device case.

6.8 CLEANING PROCEDURE

6.8.1 All alumina circuits shall be cleaned prior to bonding.

6.8.2 The cleaning process shall be as follows:

Step 1 – dip in alcohol
Step 2 – gold etch 15 seconds max with ultrasonics
Step 3 – tap water rinse 1 minute minimum
Step 4 – D.I. water rinse 1 minute minimum
Step 5 – Acetone rinse 5 seconds (approx)
Step 6 – Air dry

.0 QUALITY ASSURANCE PROVISIONS

7.1 Quality Assurance shall be responsible for audit of this procedure.

7.2 Manufacturing shall prepare a test sample for the pull strength test per any and all the following:

A. After initial equipment turn-on and set-up.
B. After 4 hours elapsed time from initial set-up and every 4 hours thereafter.
C. Anytime a (new) different circuits are to be bonded.
D. With each operator change.

7.3 Manufacturing shall maintain a log, to be kept at the bonding machine, with the information required by Table 2. Quality Assurance shall be resonsible for performing and acceptance of the pull test data.

TABLE 1
WEDGES & CAPILLARIES

TOOL	TOOL NUMBER	USED ON
Capillary	UTS-12S-CM-1/16-L	Mech-El 829Z
Capillary	UTS-12-CM-1/16-L	Mech-El 829Z
Capillary	UTS-15S-CM-1/16-L	Mech-El 829Z
Capillary	UTZ-15S-CM-1/16-XXL	Mech-El 907
Wedge	M30A-FB-1505-L-FM	Mech-El 907
Wedge	M30A-FB-1510-L-FM	Mech-El 907
Wedge	M30A-FB-1515-L-FM	Mech-El 907
Wedge	M30A FB-1520-L-FM	Mech-El 907
Wedge	M30B-FB-1505-L-FM* (foot width) .003/76	Mech-El 907
Cross Groove Wedge	GW30-FB-2020-L-CG	Mech-El-907
Cross Groove Wedge	GW30-FB-2025-L-CG	Mech-El-907
Wedge	1200A-FB-2015-L-C	Mech-El-907
Wedge	1200A-FB-2025-L-C	Mech-El-907

Suggested Source of Supply

Sigma Teleproducts Inc.
200 Oser Avenue
Hauppauge, N.Y. 11788
516-435-4700

TABLE 2

WIREBONDING LOG

BONDER #1 = Mech-El 907 Wedge

BONDER #2 = Mech-El 829=Z Ball

DATE	TIME	OPERATOR	BONDER	MATERIALS	PULL DATA	INSP STAMP
Example 10-1-83	9:00 am	KJE	#1	gold .0007	6.5 ave 1.1 std dev.	

DOCUMENT MPP 7301

Ev	DATE	CHANGED BY	APPROVED BY	APPROVED BY	APPROVED BY	DESC. OF CHANGE AND PAGES AFFECTED
	3/21/86	K. Ely	D. Mont ~~3/21/86~~ 5/15/86	J W Fonato 5/15/86	5/16/86	NEW ISSUE