

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
NONCONFORMANCE REPORT

69/93

Project No. ~~CNRA~~ Audit 2001-1

NCR No. 2001-02

PART 1: DESCRIPTION OF NONCONFORMANCE P.O X 447736 for Ag Conductive Epoxy (See Page 2)

Initiated by: D. W. Dunavant *Dave*
Action Required by: Darrell Dunn

Date: January 12, 2001

PART 2: PROPOSED DISPOSITION AND CORRECTIVE ACTION

Response Date: 1/24/2001

Disposition:

Accept data obtained with sensors fabricated by screen printing using Epo-tek epoxies as is.

Basis of Disposition: Although resistance measurements cannot be used to verify the product specifications, they were used to determine that the products were satisfactory for the corrosion sensors. The resistance was measured with a calibrated electrometer (Keithley model 614 SN 704934, Last Calibrated 3/18/00, Next Calibration Due 3/16/01). The conductive epoxy was found to be a electrical conductor (Resistance=0.012 kohms) and the insulating epoxy was determined to have a sufficient electrical resistance (Resistance ** Action to Correct Nonconformance:

Electrical resistance of the epoxies were measured and found to be satisfactory for corrosion sensors. The resistance measurements are documented in Scientific Notebook 1366 page 153.

Target date for completion: 1/24/2001

Proposed by:

Darrell Dunn

Date:

1/24/2001

PART 3: APPROVAL

Element Manager:

B. Sagar

Date:

1/24/2001

Director of QA:

Blenn Malabito

Date:

1/24/2001

Comments/Instructions:

PART 4: CLOSE OUT

Comments: *A copy of page 153 from Scientific Notebook No. 366 was reviewed and it contained the documentation of the inspection.*

Verified by:

Blenn Malabito

Date:

1/24/2001

Distribution:

Original-CENTER QA DIRECTOR QA Records
ORIGINATOR
PRINCIPAL INVESTIGATORS
ELEMENT MANAGERS
B. Sagar, H. Garcia
M. Ehrstrom/30

** >200 Gohms). No other product specifications were evaluated.

70/93

CNWRA NCR-2001-02

Part 1 -

contained requirements for “**QC** inspection required” and a requirement to verify that the epoxy “shall meet the typical properties the Epoxy Technology Product Data Sheet” and “be able to be screen printed.” Although a SwRI Receipt Traveler was signed by the ordering scientist on 05/15/00, the actual verification of properties was performed later and not documented in a project folder or scientific notebook, Reference QAP-016,7.1.2.

Dr. 4/29/2001

Sensor evaluation

Objective: measure electrical resistance of
corrosion sensors shown on p 124-126

QA Reference: NCR No. 2001-02

Materials: TYPE 304L SS NT T0954
EPO-TEK H20E ELECTROCALLY CONDUCTIVE
EPOXY - Ag DOPED
EPO TEK H54 INSULATING EPOXY

Tests to evaluate sensor and epoxy properties

Measure resistance between electrically conductive epoxy and 304L SS substrate. These layers are separated by a layer of the H54 insulating epoxy. The measured resistance should be high ($R > 1 \text{ MR}$).

Measured resistance 7200 Ω R

KEITHLEY 614 ELECTROMETER SN 704934
CALIBRATED 3/18/2000 CAL DUE 3/16/2001

Measure resistance of conductive epoxy by measuring resistance from end of lead wire attached to the Ag epoxy layer to the corner of the Ag epoxy located at the greatest distance from DD 1/22/01 from the lead wire. This is a measure of the resistance of the lead wire + the entire width of the Ag epoxy layer.

Measured resistance 0.012 KR

KEITHLEY 614 SN 704934

Paul D.
1/25/2001

Southwest Research Institute
 6220 Culebra Road
 San Antonio, TX 78238-5166

Purchase Order: X44773G

Page: 1 of 2
 Date Printed: 05/10/2000

Order To: EPOXY TECHNOLOGY
 14 FORTUNE DRIVE
 BILLERICA, MA 01821

102423

Ship To: Southwest Research Institute
 6220 Culebra Road
 San Antonio, TX 78238-5166

ORDER DATE	BUYER	TERMS	FOB	SALES ORDER	SHIP VIA	DELIVER TO
5/09 00	Erik Springer	NET 30	SHIPPING POINT		FEDEX	D. DUNN/B. 57 X6090
LINE	U/M	DUE DATE	DESIRED DATE	QUANTITY	NET UNIT COST	EXTENDED COST
<p>***** CONFIRMATION ***** This is a rated order certified for national defense use, and the requirements of the Defense Allocations System Regulation (15 CFR ***** ***** contractor shall follow all art 700).</p>						
1	MISC 1 OZ. Ag CONDUCTIVE EPOXY H20E	EA	05/12/00 05/08/00	2.0000	90.0000	\$180.00
<p>Req: 532938 QC Insp Required</p> <p>Prime Contract #: NRC0297009 AOP: 704-000 1.20</p> <p>Priority: N/A 01402.571</p>						
2	MISC 3 OZ. EPOXY H54	EA	05/12/00 05/08/00	2.0000	39.0000	\$78.00
<p>Req: 532938 QC Insp Required</p> <p>Prime Contract #: NRC0297009 AOP: 704-000 1.20</p> <p>Priority: N/A 01402.571</p> <p>QUALITY & TECHNICAL REQUIREMENTS: H20E AND H54 SHALL MEET THE TYPICAL PROPERTIES IN THE EPOXY TECHNOLOGY PRODUCT DATA SHEET. BOTH PRODUCTS MUST BE ABLE TO BE "SCREEN PRINTED." D. DUNN WILL RECEIVE AND INSPECT.</p> <p>SHELF LIFE INFORMATION IS REQUIRED WITH SHIPMENT OF THIS ORDER. IT MUST INCLUDE THE DATE OF MANUFACTURE OR DATE OF EXPIRATION, BATCH/LOT NUMBER, SHELF LIFE, AND STORAGE CONDITIONS. SPECIFICATION NUMBER(S) AND HAZARD NOTICES SHALL BE PROVIDED.</p> <p>THE GENERAL PURCHASE ORDER TERMS AND CONDITIONS ATTACHED ARE MADE PART OF THIS ORDER.</p>						

72/53

Southwest Research Institute
 6220 Culebra Road
 San Antonio, TX 78238-5166

Purchase Order: X44773G

Page: 2 of 2
 Date Printed: 05/10/2000

Order To: EPOXY TECHNOLOGY
 14 FORTUNE DRIVE
 BILLERICA, MA 01821

102423

ORDER DATE	BUYER	TERMS	FOB	SALES ORDER	SHIP VIA	DELIVER TO		
5/09 00	Erik Springer	NET 30	SHIPPING POINT		FEDEX	D. DUNN/B. 57 X6090		
LINE	ITEM/DESCRIPTION	REV	U/M	DUE DATE	DESIRED DATE	QUANTITY	NET UNIT COST	EXTENDED COST
	PLEASE SIGN AND RETURN A PHOTOCOPY ACKNOWLEDGING ORDER WITHIN 5 WORKING DAYS. "IF THIS ORDER INCLUDES A GOVERNMENT CONTRACT NUMBER, THEN ANY PROPERTY FURNISHED HEREWITH IS CONSIDERED GOVERNMENT-FURNISHED PROPERTY WHICH MUST BE ACCOUNTED FOR IN ACCORDANCE WITH FAR, PART 45. REFER TO GENERAL PURCHASE ORDER TERMS AND CONDITIONS FOR RISK OF LOSS." Bill To: Southwest Research Institute P.O. Drawer 28510 Attention: Accounts Payable San Antonio, TX 78228-0510 <hr/> Authorized Signatures						PO Total Amt:	\$258.00

73
 /53



PURCHASE REQUISITION
SOUTHWEST RESEARCH INSTITUTE

PURCHASE ORDER NO.

REQ. NO.

532938

VENDOR		DATE OF ORDER	SHIP VIA	SUGGESTED SUPPLIER		
		FOB POINT	TERMS	Epoxy Technology		
		CONTRACT NO		14 Fortune Drive		
				Billerica, MA 01821		
				978/667-3805		

ITEM	QTY.	UNIT	DESCRIPTION	ITEM IDENTIFIER	EST. COST EA.	UNIT PRICE	AMOUNT
A	2	1 oz	Ag conductive epoxy H20E				
	2	3 oz	Epoxy H54				
					\$90.00		
					\$39.00		
QUALITY & TECHNICAL REQUIREMENTS:							
H20E and H54 shall meet the typical properties							
in the Epoxy Technology Product Data Sheet.							
Both products must be able to be "Screen							
Printed". D. Dunn will receive and inspect.							
						TOTAL	

DATE ACQUIRED 5/8/00	REQUISITION DATE 5/2/00	TO BE USED FOR (G1)	DELIVER TO NAME/LOCATION D. Dunn/bldg. 57	SPECIAL INSTRUCTIONS Send all paperwork to R. Ard/bldg. 189		
ACCOUNT NO.(s) 20.01002.571	REQUESTOR'S SIGNATURE Darrell Dunn DEPARTMENTAL/DIVISIONAL APPROVAL <i>[Signature]</i> 5/3/2000 DATE		EXT.NO. 6090	1. If you have specified a brand name, would an equivalent brand or product also satisfy your need? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	2. If you have suggested a supplier for the item or service, could other suppliers meet your requirements? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	3. If this requisition is for a repair-is the repair on campus or off campus? <input type="checkbox"/> ON <input type="checkbox"/> OFF
Government Project? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		b. If "NO", will it be attached to, built into, or used as an accessory to a piece of equipment either in existence or to be constructed? <input type="checkbox"/> YES <input type="checkbox"/> NO		d. Is government furnished property being sent to vendor? <input type="checkbox"/> YES		f. QA Footnotes: 48 None <i>Ben</i>
the item is being charged to a government contract? Will it be substantially consumed, destroyed, or exhausted during the performance of the project? <input type="checkbox"/> YES <input type="checkbox"/> NO		c. If "NO", is the item uniquely required to instrument the project that is funding the purchase? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		e. QA Approval (if required) Date: 5/3/2000		g. Inspection Criteria: Q8
CONTRACT ADMINISTRATOR		BUYER SIGNATURE <i>[Signature]</i>		EXPEDITE DATE		5. Do you want receiving to open and inspect your shipment? SEE INSTRUCTIONS ON REVERSE SIDE

EPOXY

*TECHNOLOGY

DATA SHEET

EPO-TEK^{75/93}

H20E

Electrically Conductive Silver Epoxy

Rev. III
4/00

TYPICAL PROPERTIES

(To be used as a guideline only)

NUMBER OF COMPONENTS	Two
MIXING RATIO	PARTS BY WEIGHT
Part "A" (epoxy resin and silver powder)	1
Part "B" (hardener and silver powder)	1
NOTE: Mix contents of each container (A and B) thoroughly before mixing the two together.	
CURE SCHEDULE (minimum)	
175°C	45 seconds
150°C	5 minutes
120°C	15 minutes
80°C	90 minutes

PHYSICAL PROPERTIES

Color	Bright Silver
Consistency	Smooth, thixotropic paste
Specific Gravity	
Part "A"	2.03
Part "B"	3.07
Viscosity (@ 100 rpm/23°C)	2,200 - 3,200 cPs
Glass Transition Temp. (T _g)	> 80°C
(cured 150°C/1 hour)	typically 100°C
Coefficient of Thermal Expansion (CTE)	
Below T _g	31 x 10 ⁻⁶ in/in/°C
Above T _g	120 x 10 ⁻⁶ in/in/°C
Lap Shear Strength	1,500 psi
Die Shear Strength	> 10Kg/3,400 psi
Degradation Temperature	410°C
Weight Loss @ 200°C (TGA)	0.16%
Operating Temperature	
Continuous	200°C
Storage Modulus	750,000 psi

ELECTRICAL* THERMAL PROPERTIES

Volume Resistivity	< 0.0004 ohm-cm
Thermal Conductivity	2.0 W/m ² K
Thermal Resistance: (Junction to Case)	

TO-18 package with nickel-gold metallized 20 x 20 mil chips and bonded with EPO-TEK H20E (2 mils thick)

Eutectic Die attach	4.0 to 5.3°C/watt
EPO-TEK H20E	6.7 to 7.0°C/watt

Pass Thermal Shock - Gold backed silicon chips bonded to a gold metallized ceramic substrate will pass: 5 cycles from -62°C to +125°C

Banded Silicon Chips (100 x 100 mils) when placed on a 300 - 340°C heat column will resist a shear force of 16 oz.

SCHOTTKY DIODE

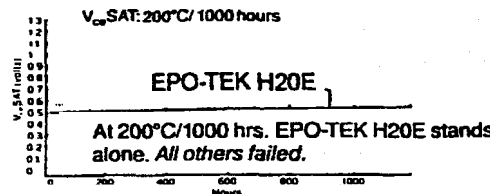
INITIAL	2 WEEKS @ 200°C
C, 1pF (typical)	
V _i ≥ 5V @ 10µa	4.8V @ 10 pa
V _i ≥ 0.4V @ 1 ma	0.32V @ 1 ma

POT LIFE 4 days

SHELF LIFE

One year when stored at room temperature.
REFRIGERATION NOT REQUIRED

TO-3 package, 2N3055 chips, medium power transistor - 4 amp pulse



H20E EXHIBITS SUPERIOR V_{ce} SAT PERFORMANCE.

EPO-TEK H20E is a 100% solids, two component silver filled epoxy with a soft, smooth, thixotropic consistency designed specifically for chip bonding in microelectronic and optoelectronic applications.

The excellent handling characteristics and the extremely long pot life at room temperature for this unique Electrically Conductive Adhesive (ECA) are obtained without the use of solvents. In addition to the high electrical conductivity, the short curing cycles, the proven reliability and the convenient mix ratio, EPO-TEK H20E is extremely simple to use and make it an ideal material for use in electronic applications. The pure silver powder is dispersed in both the resin and the hardener so that it can be used in a convenient 1:1 mixing ratio. In fact the EPO-TEK H20E is the easiest-to-use two component silver epoxy that has ever been developed for the microelectronic industry.

EPO-TEK H20E is especially recommended for use in high speed epoxy chip bonding systems where very fast cures are highly desirable. This cannot be obtained with single component systems. Because EPO-TEK H20E can be cured very rapidly, it is an excellent material for making fast circuit repairs. EPO-TEK H20E can be screen printed, machine dispensed or stamped and can withstand wire bonding temperatures in the range of 300 - 400°C.

EPO-TEK H20E has proven itself to be extremely reliable over the many years of service and is still the conductive adhesive of choice for new applications.

NASA APPROVED
NONTOXIC - complies with USP Class VI
Biocompatibility standards

When placing an order, please specify whether EPO-TEK H20E is to be used by volume or weight.

EPOXY TECHNOLOGY, INC. 14 Fortune Drive Billerica, MA 01821-3972 USA

PHONE: 978.667.3805 1.800.277.7201 FAX: 978.663.9782

This information is based on data and tests believed to be accurate. Epoxy Technology, Inc. makes no warranties (expressed or implied) as to its accuracy and assumes no liability in connection with the use or inability to use this product.

EPOXY
* TECHNOLOGY

DATA SHEET

EPO-TEK
H54

76/93

Insulating Epoxy

Rev. II
11/97

TYPICAL PROPERTIES

(To be used as a guideline only)

NUMBER OF COMPONENTS..... TWO

MIXING RATIO PARTS BY WEIGHT

Part "A" 10
Part "B" (hardener) 1

A convenient way to mix EPO-TEK H54 in small quantities is as follows:

Part "A" 1 gram
Part "B" (hardener) 2 drops

CURING SCHEDULE (minimum bond line temperature - use one of the following)

150°C 5 minutes
120°C 15 minutes
100°C 30 minutes

PHYSICAL PROPERTIES

Color Tan
Consistency Thixotropic paste
viscosity (η 23°C/20 rpm) 9,000 - 15,000 cPs
Glass Transition Temp. (T_g)
cured @ 150°C/1 hour > 100°C
Lap Shear Strength (Al to Al) 3,100 psi

ELECTRICAL PROPERTIES

Volume Resistivity 5.0 x 10¹⁵ ohm-cm
Dielectric Strength 480 V/mil
Dielectric Constant (1 megacycle) 3.0
Dissipation Factor (1 megacycle) 0.001

POT LIFE 4 hours

SHelf LIFE

One year when stored at room temperature.

REFRIGERATION NOT REQUIRED

EPO-TEK H54 is a two component epoxy for bonding or coating applications where a thin film with high insulating resistance is required, particularly at elevated temperatures. Applications for EPO-TEK H54 include bonding of active and passive components, bonding large substrates in IC packages, crossovers or mating closely spaced conductors.

EPO-TEK H54 is a 100% solids, soft, smooth thixotropic paste characterized by outstanding high temperature properties and excellent solvent, chemical and moisture resistance. Other important characteristics include a good pot life and fast curing at relatively low temperatures. EPO-TEK H54 was designed to be used in the 300°C to 400°C range for wire bonding operations.

A unique feature of EPO-TEK H54 is the built-in color indicator when the product is cured. The color changes from amber to deep red, depending on the curing conditions. It is normal for EPO-TEK H54 to turn a very deep red when subjected to wire bonding temperatures.

EPO-TEK H54 can be applied by brush, spatula, silk screen, hypodermic needle or commercial dispensing equipment.

EPOXY TECHNOLOGY, INC. 14 Fortune Drive Billerica, MA 01821-3972 USA

PHONE: 978.667.3805 1.800.227.2201 FAX: 978.663.9782

This information is based on data and tests believed to be accurate. Epoxy Technology, Inc. makes no warranties (expressed or implied) as to its accuracy.