



ATLAS SCT Barrel Module FDR/2001

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SCT-BM-FDR-5.5

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Rev. No.: A

SCT Barrel Module FDR Document

Adhesives for the barrel modules

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Distribution List

History of Changes

<i>Rev. No.</i>	<i>Date</i>	<i>Pages</i>	<i>Description of changes</i>
A	dd/mm/yy	All	First version

1 Introduction

The barrel modules are made of three major components: silicon microstrip sensors, baseboards, and hybrids. These components are fitted together with epoxy adhesives both thermally conductive and electrically conductive. In smaller parts, the readout ASICs are attached to the hybrids with an electrically conductive epoxy adhesive.

Both thermally and electrically conductive adhesives are used to adhere the baseboard and the sensors. A thermally conductive adhesive is required in order to transfer the heat generated in the sensors to the baseboard, especially after accumulating a large fluence of particles which damage the silicon bulk and induce many order of magnitude larger leakage current, together with increased full depletion voltage. Without an efficient transfer of heat from the sensors to the baseboard, the sensors may run away thermally through positive feedback of the leakage current and the temperature. An electrically conductive epoxy is required as the baseboard, made of carbon, is used for the electrical conductive path from the bias line on the hybrid to the back-plane of the sensors.

Epoxy adhesives are chosen since they are known to be radiation-tolerant up to a very high fluence [1]. Although generally accepted radiation-tolerant, it is important that the electrical and thermal properties are demonstrated after receiving the full irradiation of 2×10^{14} 1 MeV-neutron equivalent/cm² fluence expected during the 10 years operation of detectors. To this end, the barrel community has adopted the epoxy adhesives, which have shown to work throughout the prototype modules and irradiation of the sub- and full modules.

In applying the epoxies, it is important to establish consistent quality among the module assembly sites. The barrel module community has arranged to acquire one each product for thermally and electrically conductive and provide the products to all sites, together with an appropriate documentation of specification, application procedure, curing schedule, and special precautions.

2 Thermally conductive epoxy

The thermally conductive epoxy of the choice is a 2 part, room temperature curing epoxy, supplied by Ciba-Geigy. The product is AW106/HV953U, known as its part number as Araldite 2011.

In order to enhance the thermal conductivity, a boron nitride filler is added, which is supplied by Advance ceramics, grade PT140S. The boron-nitride filler is chosen, over the alumina filler, after the test of the sensitivity in increasing the leakage current in the sensors [2]. The boron-nitride has a high thermal conductivity which helps to enhance the thermal conductivity of the epoxy mixture. The thermal conductivity of the mixture is estimated to be an order of 1 W/m/K.

The thermally conductive epoxy is used in the interfaces of

- (1) the sensors and the baseboard, and
- (2) the BeO facings of the baseboard and the steps of the hybrids.

The specification document is given in the appendix 4.1.

3 Electrically conductive epoxy

The electrically conductive epoxy of the choice is a 2 part, low temperature curing, supplied by

Eon Chemie Co. Ltd. The product is Eotite p-102. Although the curing schedule listed is above 50 °C, the epoxy is shown to cure at the room temperature. A caution is that it takes a long time in the room temperature, and it may not cure below 20 °C. A test data from the vendor in the appendix shows that the full curing takes 24 hrs. or more at 23 °C.

The thermal conductivity is good because of the silver filler and is measured to be 30 to 40 W/m/K, according to the vendor.

The electrically conductive epoxy is used in the interfaces of

- (1) the sensors and the baseboard, and
- (2) the ASICs and the hybrids.

The specification document is given in the appendix 4.2.

4 Appendix

4.1 ATLAS Barrel and Forward Module Structural Epoxy Specification, by M. Gibson and F.S. Morris

4.2 Conductive Epoxy Adhesive - Low Temperature Curing Type - Eotite P-102, by Eon Chemie Co. Ltd.

References

- [1] E.g., H. Schönbacher, Radiation tests on epoxy resin NR 172, CERN LabII-RA-37.40-TM-74-6 (or any other better reference?)
- [2] M. Gibson, Evaluation of Thermally Conductive Adhesive on the 'p' Side of Hamamatsu ATLAS Specified Silicon Detectors

8-12-98
issue 1

ATLAS Barrel and Forward Module Structural Epoxy Specification

M.Gibson
F.S.Morris

RAL, Didcot, Oxon OX11 0QX, UK

Abstract

This document aims to specify the storage, handling, mixing and safety aspects of the approved ATLAS structural epoxy to be used in the construction of barrel and forward modules. The 2 part, room temperature curing epoxy (AW106/HV953U), has Boron Nitride (BN) additive to increase the thermal conductivity.

Materials.

Table 1 lists the basic constituents and the manufacturers of the loaded room temperature cure epoxy that has been agreed as the ATLAS standard for barrel and forward module construction. Table 2 lists the world suppliers for the boron nitride. Table 3 lists some of the Ciba-Geigy world offices who will supply the name of your local supplier.

TABLE 1

<i>use</i>	<i>item description</i>	<i>manufacturer</i>
structural epoxy	AW106/HV953U 2Kg pack part number 2011	Ciba-Geigy
filler	boron nitride grade PT140S	Advanced Ceramics

TABLE 2
boron nitride

European office	US Headquarters	UK office
Advanced Ceramics 54 Route de Clementy CH -1260 Nyon Switzerland	Advanced Ceramics PO box 94924 Cleveland Ohio USA 44101-4924	Advanced Ceramics Unit 3 Vale Business Park Cow Bridge Glamorgan CF71 7PF
Phone (41) 22 361 50 08 Fax (41) 22 361 50 43	Phone (1) 703 426 0320	Phone (44) 1446 773826 Fax (44) 1446 773932

TABLE 3
Araldite

Australia	Germany	Japan	Spain
Ciba-Geigy Australia Ltd po box 332 Au-Thomastown Vic 3074	Ciba-Geigy GmbH Postfach 1160/1180 D-79662 Wehr/Baden	Ciba-Geigy Japan Ltd 66-10 Miyuki-cho Takarazuka-city 665	Ciba-Geigy Sa Apartado 744 E-08080 Barcelona
phone (61) 3 282 0600 Fax (61) 3 282 0729	phone (49) 7762 820 fax (49) 7762 3727	phone(81) 797742439 Fax (81) 797742557	Phone (34) 3404 0300 Fax (34) 3404 0301
UK	USA		
Ciba-Polymers Duxford Cambridge CB2 4QA	Ciba-Geigy Corporation Formulated Systems Group 4917 Dawn Ave East Lansing Mi48823		
phone (44) 1223 83211	Phone (1) 517 3515900		

Preparation.

Fig 1 shows a typical mixing station, with P3 filters to limit dust, covered weighing station to protect the operative against splashes and extraction system to remove vapour. The resin, hardener and filler are mixed by weight in the following ratios.

Resin	Hardener	Filler
38.5 %	30.75 %	30.75 %
2.5 gm	2.0 gm	2.0 gm

Mixing.

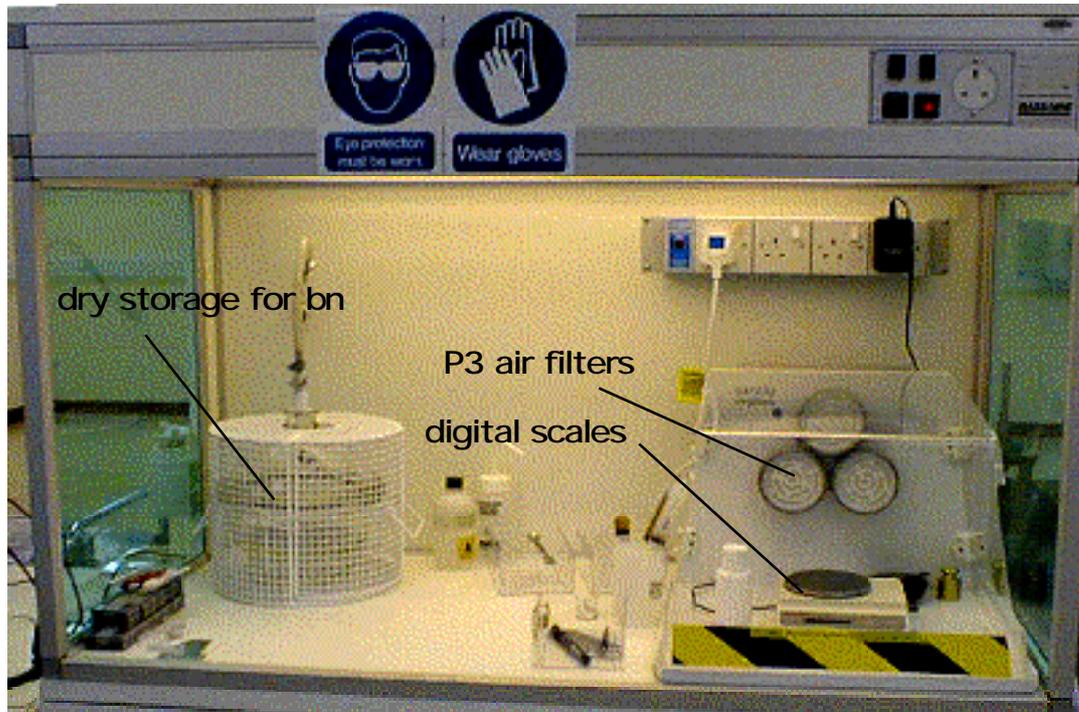
Pour the required weight of resin and hardener into a small tall container and add the boron nitride. Mix by hand for about 2 minutes. At present there is no indication that it is necessary to evacuate the mixture to remove any dissolved air. The mix has a pot life of about 1 hour.

Storage.

The boron nitride is supplied by the manufacturer in sealed containers. The user should decant it into smaller, daily use containers and store in a dry atmosphere (e.g. in a sealed container with silica gel providing an atmosphere of approximately 23% RH @ 21deg C). The resin and hardener may be stored at room temperature (e.g. 45% RH @21deg C).

Safety.

Attached are copies of material safety data sheets as supplied by the manufactures. Users should obtain their own local versions.



Ciba Polymers

SAFETY DATA SHEET

Araldite 2011

August 1993

1 SUBSTANCE/PREPARATION AND COMPANY IDENTIFICATION**CHEMICAL NATURE**

Resin Component: Bisphenol A epoxy resin containing fillers
 Hardener Component: Mixture of polyaminoamide and aliphatic polyamine
 Preparations

COMPANY

Ciba Polymers
 Duxford, Cambridge
 England CB2 4QA

Tel: (0223) 832121
 Fax: (0223) 838690

EMERGENCY TELEPHONE:

+44 (0223) 832121

2 COMPOSITION/INFORMATION ON INGREDIENTS**RESIN COMPONENT CONTAINS**

75-87% Bisphenol A epoxy resin (CAS No: 25068-38-6)
 EEC-Symbol: Xi R phrases: 36/38-43

HARDENER COMPONENT CONTAINS

7-13% N(3-Dimethylaminopropyl)-1,3-propylenediamine (CAS No: 10583-29-8)
 EEC-Symbol: Xi R phrases: 36/38-43

3 HAZARDS IDENTIFICATION

Irritating to eyes and skin. May cause sensitisation by skin contact.

4 FIRST-AID MEASURES**Skin Contact**

Wipe with absorbent paper disposable towels. Wash with plenty of soap and water. Do not use organic solvents. In case of dermatitis get medical attention.

Eye Contact

Rinse immediately with water for at least 15 minutes and seek medical attention.

Inhalation

Move affected person to fresh air. In case of irritation of respiratory system or mucous membranes, or if you feel unwell or in case of prolonged exposure, get medical attention.

Ingestion

Immediately rinse the mouth repeatedly with water. If swallowing has occurred drink plenty of water. Seek medical attention promptly.

REPRODUCTION COPY ISSUE DATE: 21/1/94
 NOT REMOVE OR APPROVED.



5 FIRE-FIGHTING MEASURES

Suitable Extinguishing Media

Water mist; Carbon dioxide; Foam; Dry powder

Unsuitable Extinguishing Media

High pressure water jet

Exposure Hazards

Do not release chemically contaminated water into drains, soil or surface water. Sufficient measures must be taken to retain water used for extinguishing. Dispose of contaminated water and soil according to local regulation.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions

Avoid contact with skin, eyes and clothing

Environmental Precautions

Prevent contamination of soil, drains and surface waters.

Methods for Cleaning

Take up with absorbent, inert material and place in suitable and closable container for disposal.

7 HANDLING AND STORAGE

Handling

Irritant, sensitising. Ensure good ventilation and local exhaust. Do not eat, drink or smoke at the workplace.

Storage

Keep away from food and drink. Store in the original container securely closed and at room temperature.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Technical Protective Measures

No special measures required

Exposure Control Limits

None

Respiratory Protection

Not normally necessary. Work in well ventilated area.

Hand Protection

Wear suitable gloves

Eye Protection

Wear suitable goggles or face protection

Skin Protection

Wear overalls and closed footwear

9 PHYSICAL AND CHEMICAL PROPERTIES**RESIN COMPONENT**

Appearance: Cream liquid
 Odour: Slight
 Density: 1.15 - 1.26 g/cm³ at 25°C
 Flashpoint: > 200°C DIN 51758
 Ignition: Not available
 pH value: 6 - 7 at 1:1 mixture with water
 Viscosity: 24 - 45 Pa s at 25°C

Melting point/range: Not applicable
 Boiling point/range: Not available
 Oxidizing properties: Not available
 Autoflammability: Not available
 Solubility in water: Pract. insoluble at 20°C
 Vapour pressure: 0.1 Pa at 20°C
 Partition coeff.: Not available
 Explosive properties: Not available

HARDENER COMPONENT

Appearance: Brownish yellow liquid
 Odour: Slight
 Density: 0.94 - 0.98 g/cm³ at 25°C
 Flashpoint: > 110°C DIN 51758
 Ignition: Not available
 pH value: 12 at 1:1 mixture with water
 Viscosity: 20 - 30 Pa s at 25°C

Melting point/range: Not applicable
 Boiling point/range: Not available
 Oxidizing properties: Not available
 Autoflammability: Not available
 Solubility in water: Pract. insoluble at 20°C
 Vapour pressure: ca. 4 Pa at 20°C
 Partition coeff.: Not available
 Explosive properties: Not available

10 STABILITY AND REACTIVITY

Thermal Decomposition: > 200°C

Conditions to Avoid: Static discharges

Materials to Avoid: Strong acids, strong bases and strong oxidizing agents

Hazardous Decomposition Products

Thermal decomposition or burning may release oxides of carbon and other toxic gases or vapours.

11 TOXICOLOGICAL INFORMATION

	RESIN COMPONENT	HARDENER COMPONENT
LD ₅₀ Acute oral toxicity in rats:	> 5000 mg/kg	> 5000 mg/kg
Eye irritation tested in rabbits:	Not irritant	Not irritant
Skin irritation tested in rabbits:	Not irritant	Not irritant
Skin sensitisation in guinea pigs:	May cause sensitisation by skin contact	May cause sensitisation by skin contact

12 ECOLOGICAL INFORMATION

Prevent contamination of soil, drains or surface water.

	RESIN COMPONENT	HARDENER COMPONENT
LC ₅₀ Zebra fish (96h):	Not available	Not available
LC ₅₀ Rainbow trout (96 h):	Not available	Not available
EC ₅₀ Daphnia magna (24 h):	Not available	Not available
Biodegradability (Sturm test):	Not available	Not available
Algae Inhibition Test:	Not available	Not available
Sludge toxicity:	Not available	Not available

13 DISPOSAL CONSIDERATION

Incineration or landfill in accordance with local regulations. Contaminated packaging materials should be disposed of identically to the product itself. Packaging materials that are not contaminated should be treated as household waste or as recycling material. For easy disposal any unmixed resin and hardener can be mixed and allowed to cure. Once fully cured Araldite 2011 can be disposed of as normal household waste.

14 TRANSPORT INFORMATION

RID/ADR: Free
IMDG-Code: Free
IATA: Free
Flashpoint: > 110°C DIN 51758

15 REGULATORY INFORMATION**RESIN COMPONENT**

Symbol: Xi
Contains: Bisphenol-A epoxy resin
R 36/38: Irritating to eyes and skin.
R 43: May cause sensitisation by skin contact.
S 24/25: Avoid contact with skin and eyes.

HARDENER COMPONENT

Symbol: Xi
Contains: N (3-Dimethylamino propyl)-1, 3-propylenediamine
R 36/38: Irritating to eyes and skin
R 43: May cause sensitisation by skin contact
S 24/25: Avoid contact with skin and eyes

16 OTHER INFORMATION

Product Use: Araldite 2011 is a two-component, room temperature curing epoxy industrial adhesive.

Note: Araldite 2011 is available in larger pack sizes under designation Araldite AW 108 and Hardener HV 953U.

Edition: 01 according to Directive 91/155/EEC
Editor: Product Safety & Registration Fax +44 (0)223 838690

All information is based on results gained from experience and tests and is believed to be accurate but is given without acceptance of liability for loss or damage attributable to reliance thereon as conditions of use lie outside our control. Users should always carry out sufficient tests to establish the suitability of any products for their intended applications. No statements shall be incorporated in any contract unless expressly agreed in writing nor construed as recommending the use of any product in conflict with any patent. All goods are supplied subject to CIBA-GEIGY's General Conditions of Sale.



Advanced Ceramics
CORPORATION

MATERIAL SAFETY DATA SHEET

POLAR THERM™

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

Advanced Ceramics Corporation
P.O. Box 94924, Cleveland, OH 44101-4924
11907 Madison Ave., Lakewood, OH 44107-5026
(216) 529-2900

EMERGENCY TELEPHONE NO.:
24 hr. CHEMPREC: 1-800-421-9000

TRADE NAME: Polar Therm™

MSDS NUMBER: 203

CHEMICAL NAME: Boron Nitride

SYNONYMS: Not Applicable

PREPARED BY:
Elayton Environmental Consultants, Inc.

DATE OF ISSUE/REVISION:
October 2, 1995/April 22, 1997

2. INGREDIENTS

Component	CAS #	Percent	ACGIH (TLV)	OSHA (PEL)	Units
Boron Nitride	10043-11-5	> 95	10 (T) 3 (R)	15 (T) 5 (R)	mg/M ³ mg/M ³
Boric Oxide	1303-86-2	< 5	10 (T)	15 (T) 5 (R)	mg/M ³ mg/M ³
Proprietary Filler	NA	< 5	Not Est.	Not Est.	Not Est.

The total concentration of the Boric Oxide and Proprietary Filler components of the product is less than 5%.

T = Total Dust
R = Respirable Dust

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Product is a white powder with no odor. Dusts may cause eye, skin, and respiratory tract irritation. Wear appropriate personal protective equipment. Keep individuals not involved in the cleanup out of the area. Pick up with appropriate implements and place in suitable containers for reuse or disposal. Although the product itself is considered non-hazardous, all wastes generated during cleanup operations should be treated as hazardous unless specific testing, including TCLP, shows them to be non-hazardous. The product is not expected to present an environmental hazard.

3. HAZARDS IDENTIFICATION (Continued)

POTENTIAL HEALTH EFFECTS:

Eye: May cause irritation.

Skin Contact: May cause irritation.

Skin Absorption: Not absorbed through the intact skin.

Ingestion: No known effects.

Inhalation: May cause irritation.

Chronic & Carcinogenicity: Prolonged exposures to high concentrations of the product may cause a benign pneumoconiosis. The product is not known to be a carcinogen or suspected carcinogen. May possibly aggravate pre-existing lung skin disorders.

4. FIRST AID MEASURES

Inhalation: Remove exposed person to fresh air. If breathing is difficult oxygen may be administered. If breathing has stopped, artificial respiration should be started immediately. Seek medical attention.

Eyes: Flush with tepid water for at least 20 minutes holding the eyelids wide open. Seek medical attention if irritation develops.

Skin: Wash thoroughly with mild soap and water. Seek medical attention if irritation develops. Remove any contaminated clothing and launder thoroughly before reuse.

Ingestion: Not expected to be an important route of entry into the body. If large amounts of the product are ingested, give 2 glasses of water. Never give anything by mouth to an unconscious person. Seek medical attention.

5. FIRE FIGHTING MEASURES

FLASH POINT: NA LEL: NA UEL: NA AUTO IGN. TEMP: NA

Product is non-flammable. Product in or near fires should be cooled with a water spray or fog, if compatible with the other materials involved in the fire. Fire-fighters should wear self-contained breathing apparatus, operating in the positive pressure mode and full fire fighting protective equipment should be worn for combating all fires.

6. ACCIDENTAL RELEASE MEASURES

Pick up with suitable implements and return to original or other appropriate container if product is reusable. If not reusable, place in DOT approved containers for disposal. See Section 13. Keep unnecessary personnel out of area. Wear appropriate personal protective equipment.

7. HANDLING AND STORAGE

Do not store with or near incompatible materials cited in Section 10. Store in tightly closed containers out of contact with the elements. Good housekeeping and engineering practices should be employed to prevent the generation and accumulation of dusts. Wet mopping or vacuuming with a unit that contains a HEPA filter is recommended to clean up any dusts that may be generated during handling and processing.

8. EXPOSURE CONTROL - PERSONAL PROTECTION

ENGINEERING CONTROLS: Local exhaust ventilation should be provided to maintain exposures below the limits cited in Section 2. Design details for local exhaust ventilation systems may be found in the latest edition of "Industrial Ventilation: A Manual of Recommended Practices" published by the ACGIH Committee on Industrial Ventilation, P.O. Box 16153, Lansing, MI 48910. The need for local exhaust ventilation should be evaluated by a professional industrial hygienist. Exhaust ventilation systems should be designed by a professional engineer.

RESPIRATORY: If exposures exceed the limits cited in Section 2 by less than a factor of ten, use as a minimum a NIOSH approved 1/2 facepiece respirator equipped with cartridges approved for particulate matter with an exposure limit of not less than 0.05 mg/M³. If exposures exceed 10 times the recommended limits, consult a professional industrial hygienist or your respiratory protective equipment supplier for selection of the proper equipment. The evaluation of the need for respiratory protection should be determined by a professional industrial hygienist.

EYE PROTECTION: Safety glasses with side shields are recommended for all operations.

PROTECTIVE GLOVES: Polymeric gloves are recommended to prevent possible irritation.

GENERAL: Polymeric coated apron or other body covering is recommended where there is a possibility of regular work clothing becoming contaminated with the product. All soiled or dirty clothing and personal protective equipment should be thoroughly cleaned before reuse.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE & PHYSICAL STATE: White powder

MELT POINT: Filler = 1300 °C
Boron Nitride/Boric Oxide
Sublimes at 3000 °F (1650 °C)

VAPOR DENSITY (AIR=1): Not Applicable

OCTANOL/WATER PARTITION COEFFICIENT: Not Applicable

VAPOR PRESSURE: Not Applicable

EVAPORATION RATE BuOAC = 0:
Applicable

ODOR: None

SPECIFIC GRAVITY/BULK DENSITY:
SG = 2.1 - 2.2 g/cc

% VOLATILE BY VOLUME: Not Volatile

% SOLUBILITY (H₂O): <5% Filler,
Boron Nitride/Boric Oxide = Insoluble

BOILING POINT: Not Determined

pH: Not Applicable

OTHER: Not Applicable

10. STABILITY AND REACTIVITY

STABILITY & POLYMERIZATION: Product is stable. Hazardous polymerization does not occur.

INCOMPATIBILITY (CONDITIONS TO AVOID): Strong oxidizing and reducing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: Combustion or thermal decomposition of the proprietary filler may liberate oxides of carbon and low molecular weight silicon materials whose composition and toxicity has not been determined. The boron nitride/boric oxide components of the product are stable to 3000 °F (1650 °C), which point sublimation occurs.

SPECIAL SENSITIVITY: None that are known.

11. TOXICOLOGICAL INFORMATION

Soluble boron compounds are known to have a toxic effect on the central nervous system at high exposure levels. The boron compounds present in the product are present in an insoluble, inert matrix and are not expected to be bio-available.

The proprietary filler has been shown to cause developmental abnormalities in the offspring of rats who were fed a minimum of 600 grams per kilogram of body weight per day for the three months prior to and during pregnancy. These results are not meaningful to the human model since the minimum daily dose rate required to produce the observed adverse effects is equivalent to 60% of the body weight of the average female.

12. ECOLOGICAL INFORMATION

Product is inert. It is not expected to present an environmental hazard.

13. DISPOSAL CONSIDERATIONS

As prepared, product is considered non-hazardous. It should be disposed of in an EPA approved landfill in accordance with all local, state, and federal regulations. If used or waste product is disposed of, testing including TCLP, should be conducted to determine hazard characteristics. Empty containers will have product residues. Observe proper safety and handling precautions. Do not allow empty containers or packaging to be used for any purpose except to ship original product.

14. TRANSPORTATION INFORMATION

Not currently regulated under DOT.

15. REGULATORY INFORMATION

OSHA Hazard Communication Categories: Irritant.

The product is not reportable under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986.

16. OTHER INFORMATION

NA = Not Applicable

HMIS Classification: Health = 1, Fire = 0, Reactivity = 0

All components of the product are included in the Toxic Substances Control Act (TSCA) inventory.

NOTICE TO USERS: Advanced Ceramics requests the users of this product to study this material safety data sheet (MSDS) and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify its employees, agents, and contractors of the information on this MSDS and any product hazard and safety information, (2) furnish this same information to each of its customers for the product and, (3) request such customers to notify their employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Advanced Ceramics. We believe that the information contained herein is current as of the date of this MSDS. Since the use of this product is not within the control of Advanced Ceramics, it is the user's obligation to determine the conditions of safe use of this product.

Conductive Epoxy Adhesive

- Low Temperature Curing Type -

E O T I T E P - 1 0 2

EOTITE P-102 is a two-component type Epoxy resin adhesive with fine-grained silver cured under a low temperature. Two parts of the hardner shall be added to 100 parts of the resin by weight for curing.

The adhesive is applicable for bonding metals, ceramics, plastics, carbon, glass, phenolic resin, epoxy resin, ferite, etc. requiring a perfect electroconductivity of the adhesive to be used for bonding .

Characteristics

1. Cured at low temperature of 50°C - 80°C.
2. Easy to mix the resin and the hardner with a creamy paste resin.
3. No shrinkage with cure. Suitable for filling and potting.
4. High bond strength. No sagging.
5. Excellent storage stability of one year at an ordinally temperature.

Specifications

	Resin	Hardner
Main Component	Silver / Epoxy	Polyamine
Mix Ratio (% by weight)	100	2
Specific Gravity (@20°C)	3.0 - 3.2	1.0
Viscosity (@20°C)	creamy paste	30 - 40 cps.
Purity (% of Ag)	99.5 or more	-
Particle Size (μ m,diameter)	0.5 - 1.2	-
Condition for Curing	50°C x 2 hrs - 80°C x 15 min.	
Volume Resistivity	5 x 10 ⁻⁴ Ω · cm	
Surface Resistivity	0.05 Ω / □	
Pot Life after Mixed	3 - 5 hrs. at 25°C	
	100 - 120 hrs. at -20°C	
Storage Stability (@20°C)	approx. 1 year	

Curing Condition (100 pts of resin / 2 pts of hardner by weight)

Condition		Volume Resistivity (Ω · cm)
Temperature (°C)	Time Heating	
50	2 hrs.	1.5 x 10 ⁻²
60	2 "	1.0 x 10 ⁻²
70	20 min.	8.0 x 10 ⁻³
80	15 "	5.0 x 10 ⁻⁴
100	10 "	5.0 x 10 ⁻⁴

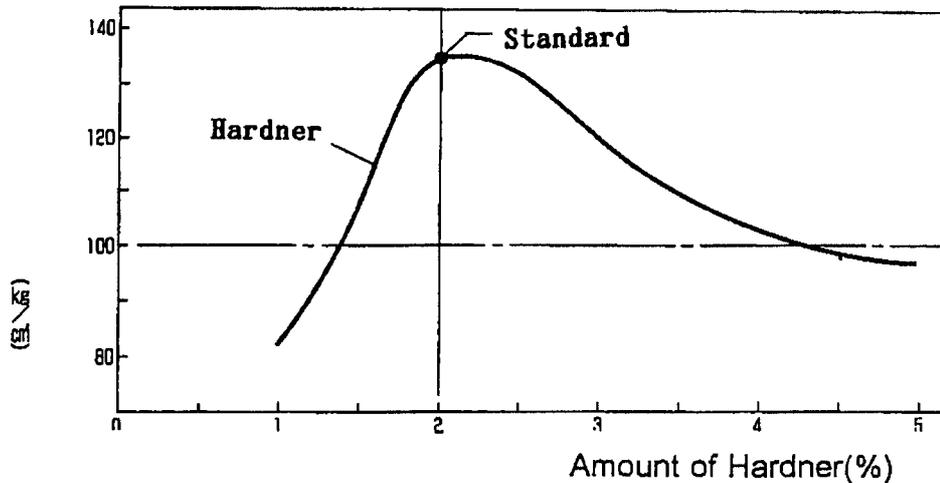
Cautions on Handling

1. Allowed to be stored at room temperature avoiding a direct sunlight.
2. Keep the cap of the container tightly protect against moisture after use.
3. Avoid to contact with skin. Preferable to wear a mask and gloves.
4. Wash hands thoroughly after use.

Correlation between Amount of Hardner and Bond Strength

(Result by change of amount of hardner to 100 pts. resin by weight)

Tensile Shear Strength (kg / cm)



(Bonded Steel to Steel)

Bond Strength

Substrates	Tensile Shear Strength	Remark
Steel / Steel	140.0 kg · cm ²	Cohesive Failure
Epoxy / Epoxy	83.5 "	Broken Substrate
Phenolic / Phenolic	66.5 "	" "

Mix Ratio: 100 pts of Resin / 2 pts of Hardner
 Curing Condition: 80°C x 15min.
 Measured after aged for 24 hours at room temperature.

Heat Resistance

- Heated for 1 hour at 190°C -

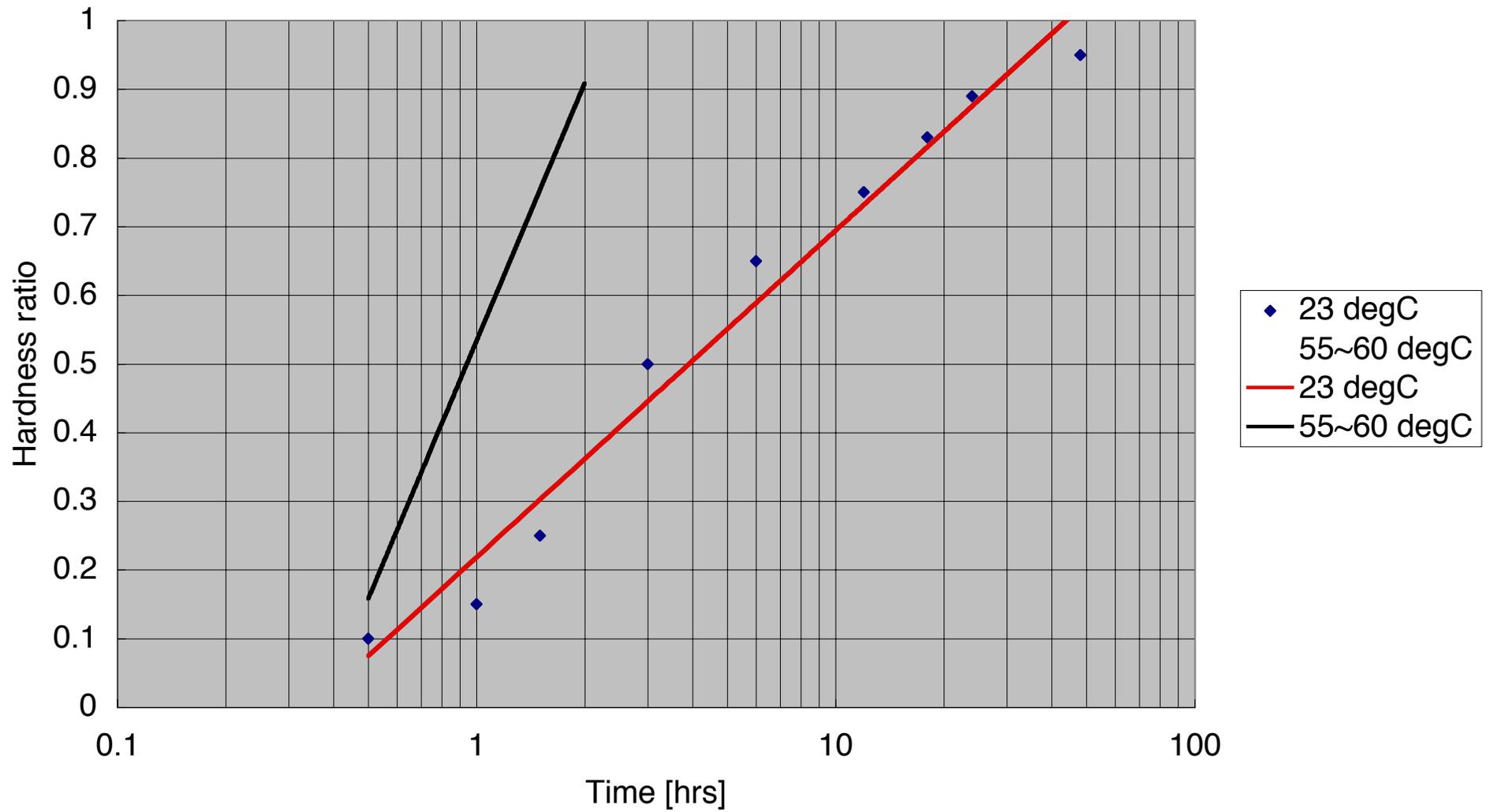
Aging Time after Cured	Tensile Shear strength	Volume Resistivity
0 min.	145 kg / cm ²	---
15 "	135 "	5 x 10 ⁻⁴ Ω · cm
24 hrs.	145 "	5 x 10 ⁻⁴ "

Bonded Substrates: steel / steel
 Curing Condition: 80°C x 15 min.
 Tested after aged for 24 hours at room temperature.

How to Use EOTITE P-102

1. Weigh correctly the resin and the hardner.
2. Mix well.
3. Use the mixed adhesive within 2 - 3 hours after mixed.
 Preferable to weigh an adequate quantity to finish to use within a time of pot life.

Eotite p-102 curing time
(reproduced from company's data)



M S D S
(製品安全性データシート)

名称	導電性エポキシ系接着剤・イオタイトP-102
物質の特定	化学名：エポキシ樹脂、銀粉、安定剤・硬化剤 β アミンを含む混合物 既存化学物質汎用グレード NO.7-1283 (Epoxy resin) CAS NO.7440-22-4 (Silver Compound) 輸出(入)統計品目 NO.7106 (Silver Compound)
性状	導電性(銀系)エポキシ接着剤はエポキシ基2個以上を含む可溶性の β アミンで硬化剤 β アミンを加えて加熱により、接着力を発揮し強力に接着する、接着後の収縮はない
危険性 有害性	引火性なし、ただし硬化剤なしでも70°C以上で重合反応をおこす アレルギー体質の人はヒフが刺激されかゆみや炎症を生じることがある。飲み込むと咽喉や胃に刺激を感じるから注意 硬化剤 β アミンは触れると発疹をおこす
応急処置	目に入った時：ただちに流水で洗眼し、医師の手当てを受ける ヒフ付着の時：付着の部位を石けんで良く洗い、炎症が生じたときは医師の手当てを受ける 飲み込んだ時：多量の水または食塩水を飲ませて吐かせ、直ちに医師の手当てを受ける 吸入した時：新鮮な空気を入れ替え、通風の良い場所に寝かせ、医師の手当てを受ける 硬化剤 β アミンがヒフに触れたときは、その部位を、ただちに石鹸水でよく洗う
火災時の措置	消火方法：火元の燃焼源を断ち、消火剤を使用して消火する消火に当たっては呼吸用保護具を着用する 消火剤：粉末(ABC)、アルコールム
漏洩時の措置	㊸少量の場合は布等で拭き取り、その後アルコール等でよく拭く ㊹大量の場合はフローア用のワイパーやヘラ等をかき集めて、空の容器へ回収する、その後洗剤と水でよく洗い流しておく
取扱および貯蔵上の注意	取扱上の注意 ㊸容器からの出し入れは遺漏のないように注意する ㊹作業時は目、ヒフおよび着衣にふれないようにし、必要に応じて保護具を着用する ㊺作業場所は換気をおこなう、なるべく局所排気装置を設置する ㊻使用済の容器は廃棄業者に依頼する ㊼使用時は熱源を避ける 貯蔵上の注意 ㊸冷暗所(20°C以下)に密閉して保存する ㊹直射日光ならびに熱源近くの場所には貯蔵してはいけない ㊺湿気を避けて貯蔵する

暴露防止装置

- 管理濃度 ・ 特になし 許容濃度 ・ 特になし
- 設備対策 ・ 作業場所にはなるべく局所排気装置を設け、熱源は避ける
- 防護具 ・ 状況に応じ、保護マスク、保護メガネ、保護手袋を着用する

物理／化学的性質（主剤）

- 外観 ・ 銀色ペースト状 沸点 ・ -----
- 粘度 ・ 25±30 ps/20℃ 蒸気圧 ・ 0.1mmHg 以下
- 比重 ・ 3.0～3.2 /20℃ 融点 ・ -----
- 臭気 ・ 微臭 溶解度 ・ 水に不溶、有機溶剤に可溶

不純物イオン濃度

- Na ・ 10 ppm 以下 at 100℃×20hrs 抽出
- Cl ・ 10 ppm 以下 at 100℃×20hrs 抽出

有害情報

- 急性毒性 ・ LD₅₀ (ラット経口) 50～100g …… Ag: 推定値
- 刺激性 ・ 人によっては刺激臭を感じる
- 感作性 ・ 人によっては刺激臭を感じる

環境負荷化学物質含有量

P R T R (化学物質排出管理法) : 該当なし

輸送上の注意

- ③ 運搬に際しては容器に漏れのないことを確認し、容器の損傷がないように梱包に注意して輸送する
- ④ 輸送中に水分が当たらないように注意する

廃棄上の注意

- ③ 廃棄は所定の容器に入れ、産業廃棄物認可業者に依託する
- ④ 主剤、硬化剤が付着している容器も同様に依託する

適用法令

- 労働安全衛生法 …… 該当なし
- 毒物及び劇物取締法 …… 該当せず
- 危険物船舶運送及び貯蔵規制 …… 該当なし

引用文献

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