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issue 1

ATLAS Barrel and Forward Module Structural Epoxy Specification

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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

use	*item description*	*manufacturer*
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 Clevland 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 Lancing 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 hardner 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 atmsphere of approximately 23% RH @ 21deg C). The resin and hardner 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.

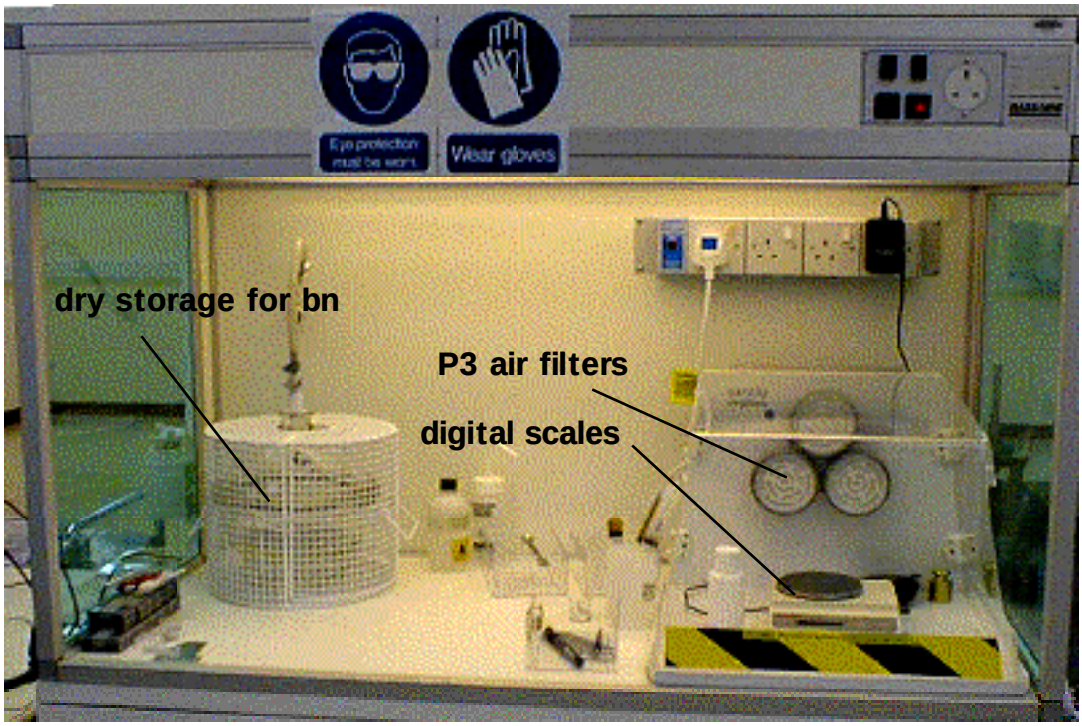

Fig 1

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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: 10563-29-8)
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.

[redacted]ER COPY ISSUE DATE: 2/1/94
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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	Melting point/range:	Not applicable
Odour:	Slight	Boiling point/range:	Not available
Density:	1.15 - 1.25 g/cm³ at 25°C	Oxidizing properties:	Not available
Flashpoint:	> 200°C DIN 51758	Autoflammability:	Not available
Ignition:	Not available	Solubility in water:	Pract. insoluble at 20°C
pH value:	6 - 7 at 1:1 mixture with water	Vapour pressure:	0.1 Pa at 20°C
Viscosity:	24 - 45 Pa s at 25°C	Partition coeff.:	Not available
		Explosive properties:	Not available

HARDENER COMPONENT

Appearance:	Brownish yellow liquid	Melting point/range:	Not applicable
Odour:	Slight	Boiling point/range:	Not available
Density:	0.94 - 0.98 g/cm³ at 25°C	Oxidizing properties:	Not available
Flashpoint:	> 110°C DIN 51758	Autoflammability:	Not available
Ignition:	Not available	Solubility in water:	Pract. insoluble at 20°C
pH value:	12 at 1:1 mixture with water	Vapour pressure:	ca. 4 Pa at 20°C
Viscosity:	20 - 30 Pa s at 25°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
S24/25:	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 106 and Hardener HV 953U.

Edition: 01 according to Directive 91/155/EEC
Editor: Product Safety & Registration Fax +44 (0223) 838690

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. CHEMTREC: 1-800-424-9300

TRADE NAME: Polar Therm™ Grade 203

MSDS NUMBER: 203

CHEMICAL NAME: Boron Nitride

SYNONYMS: Not Applicable

PREPARED BY:
Clayton 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/M³ mg/M³
Boric Oxide	1303-86-2	< 5	10 (T)	15 (T) 5 (R)	mg/M mg/M
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 or 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.:**

Product is non-flammable. Product in or near fires should be cooled with water spray or fog, if compatible with the other materials involved in the fire. 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 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/M^3. 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 most 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

VAPOR DENSITY (AIR=1): Not Applicable

VAPOR PRESSURE: Not Applicable

ODOR: None

% VOLATILE BY VOLUME: Not Volatile

% SOLUBILITY (H_2O): <5% Filler, Boron Nitride/Boric Oxide = Insoluble

pH: Not Applicable

MELT POINT: Filler = [illegible] Boron Nitride/Boric Oxide Sublimes at 3000 F [illegible]

OCTANOL/WATER PARTITION COEFFICIENT: Not Applicable

EVAPORATION RATE BuOAC = 1: Applicable

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

BOILING POINT: Not Determined

OTHER: Not Applicable

10. STABILITY AND REACTIVITY

STABILITY & POLYMERIZATION: Product is stable. Hazardous polymerization will 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 organic 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), at 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 store or 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.