

ROSSINI2 test samples description

Irradiation campaigns December 2015 and January 2016

<i>Written by</i>	<i>Responsibility</i> + handwritten signature if no electronic workflow tool
M. Giraud	ROSSINI2 study manager
<i>Verified by</i>	
<i>Approved by</i>	

Approval evidence is kept within the documentation management system.

THALES ALENIA SPACE CONFIDENTIAL

CHANGE RECORDS

ISSUE	DATE	§ CHANGE RECORDS	AUTHOR
1	Nov 2015	Issue 1	M.Giraud

THALES ALENIA SPACE CONFIDENTIAL

TABLE OF CONTENTS

1. INTRODUCTION	4
1.1.1 Applicable Documents	4
1.1.2 Reference Documents	4
1.2 List of acronym.....	4
2. MATERIAL LIST.....	5
2.1 Material list of December 2015 irradiation test campaign.....	5
2.1.1 Honeycomb Al.....	6
2.1.1.1 Safety Issue.....	6
2.1.2 Zotek F30.....	7
2.1.2.1 Safety Issue.....	7
2.1.3 Al 2024.....	8
2.1.3.1 Safety Issue.....	8
2.1.4 CFRP panels.....	9
2.1.4.1 Safety Issue.....	9
2.1.5 Kevlar Resins MDPS.....	10
2.1.5.1 Safety Issue.....	10
2.1.6 PSU.....	11
2.1.6.1 Safety Issue.....	11
2.1.7 Nextel MDPS.....	12
2.1.7.1 Safety Issue.....	12
2.1.8 Inflatable MDPS Kevlar+Bladder	13
2.1.8.1 Safety Issue.....	14
2.1.9 VECTRAN fibers	14
3. TEST CONFIGURATION	15

TABLE OF ANNEX

APPENDICES : NEXTEL SAFETY DATASHEET.....	16
APPENDICES : TEST SAMPLES LIST	24

THALES ALENIA SPACE CONFIDENTIAL

1. INTRODUCTION

In this document information about the materials produced and procured by Thales Alenia Space Italia (TAS-I) for the ROSSINI2 irradiation test campaign are given.

1.1.1 Applicable Documents

- [AD1] Invitation to Tender AO/1-6765/11/NL/AT: "Radiation Shielding by ISRU and/or innovative materials for EVA, vehicles and habitats"
- [AD2] ROSSINI2 Proposal

1.1.2 Reference Documents

- [RD1] NASA
- [RD2] ZOTEK™ F30 Product Data Sheet
- [RD3] R. Destefanis, "SPACE ENVIRONMENT CHARACTERISATION OF KEVLAR® : GOOD FOR BULLETS, DEBRIS AND RADIATION TOO"
- [RD4] 3M™ Nextel™ Fiber 312 and 440 10/28/14 Safety Data Sheet

1.2 List of acronym

CFRP	Carbon Fiber Reinforced Plastic
ESA	European Space Agency
ISS	International Space Station
MDPS	Micro-Meteoroids and Debris Protection System
MLI	Multi Layer Insulator
RD	Reference Document
ROSSINI	Radiation Shielding by ISRU and/or Innovative Materials of EVA, Spacecraft and Habitats
TBD	To be Determined
TAS-I	Thales Alenia Space Italia

THALES ALENIA SPACE CONFIDENTIAL

2. MATERIAL LIST

Different kinds of materials were provided and/or produced in order to reproduce typical deep space habitats configurations and to test them under different kinds of radiation.

In particular, one of the goal of ROSSINI2 is to study the effects of layering on the radiation field found inside a typical deep space or planetary habitat, therefore each material has been kept separated from the others, to allow the mounting and consequent testing of different arrangements.

The provided materials will allow the creation of multilayer configurations able to reproduce both traditional and inflatable concepts.

In the following paragraphs the description of the sample materials is given.

2.1 Material list of December 2015 irradiation test campaign

The following materials have been selected for the first irradiation test campaigns.

#	Description / Code	Material name	x [mm]	y [mm]	z [mm]	Density [g/cm ³]	Aeric Density [g/cm ²]
1	GE27261	Al 5056	200	200	57	2.64	-
2	GT30570	Al 5056	200	200	60	2.64	-
3	Zotek F30	Zotek F30	200	200	25.4	0.03	0.0762
4	GN01582	Al 2024-0 clad	200	200	0.508	2.78	0.1412
5	GP3092	T3001k	200	200	0.6	1.5	0.0900
6	GT27969	Al 2024-T8	200	200	1	2.78	0.2780
7	GP30942	T3001k	200	200	1	1.5	0.1500
8	18 kevlar layer in epoxy resins	Kevlar Resins	300	300	6	1.1667	0.7000
9	PPSU	Polyphenylsulfon	192	192	31	1.2900	3.9990
10	Nextel 8 layers	Nextel 8			7	1.1429	0.8000
11	Inflatable Kevlar+Bladder	Kevlar layer	300	300	-	-	0.0280
		Bladder	300	300	-	-	
12	Nextel 4 layers	Nextel 4	-	-	3.5	1.1429	0.4000
13	VECTRAN	VECTRAN					

A description of each one of them follows.

THALES ALENIA SPACE CONFIDENTIAL

2.1.1 Honeycomb Al

Honeycomb structures have the geometry of a honeycomb and are used in space to allow the minimization of the amount of used material to reach minimal weight and minimal material cost keeping, at the same time, relative high out-of-plane compression properties and out-of-plane shear properties.

There are many shapes and features possible for honeycombs and in the framework of this project two different samples are provided, of the same Aluminum alloy, Al 5056, and with different hexagonal cells densities.

Test sample #1 and #2 pictures are reported in the next figure.



Figure 2-1: Honeycomb test samples of different densities

Aluminum 5056 composition is given here below, in weight percentages.

Al 5056				
Al	Si	Fe	Cu	Mn
93.95	0.2	0.3	0.1	0.125
Mg	Cr	Ni	Zn	Ti
5.1	0.125	0	0.1	0

2.1.1.1 Safety Issue

Sharp edges, handle with care.

2.1.2 Zotek F30

ZOTEK™ F 30 is a closed cell foam of density 1.9 pcf made from KYNAR® PVDF (polyvinylidene fluoride) available in sheet form. The material can be thermoformed into simple and complex shapes and is a remarkable material. It shows in fact exceptionally wide temperature tolerance (to 160 degrees C), excellent UV, nuclear radiation and ageing resistance, high dielectric strength and outstanding resistance to a wide range of solvents and aggressive chemicals [RD2].

It is used in the spacecraft internals, both in inflatable and in rigid module configurations.

Test sample #3 is a piece of Zotek F30 of 200x200x 25.4 mm, with an aeric density of 0.03 g/cm³.



Figure 2-2: test sample #3, Zotek F30 foam slab

2.1.2.1 Safety Issue

None

2.1.3 Al 2024

Aluminum 2024 is one of the most used materials in space.

It is used both to guarantee structural resistance both to protect the spacecraft from debris and micrometeoroids.

3 pieces of 0.508 mm of thickness and 5 of 1 mm are provided, in order to be able to test multilayered configurations where this materials is employed in different ways.

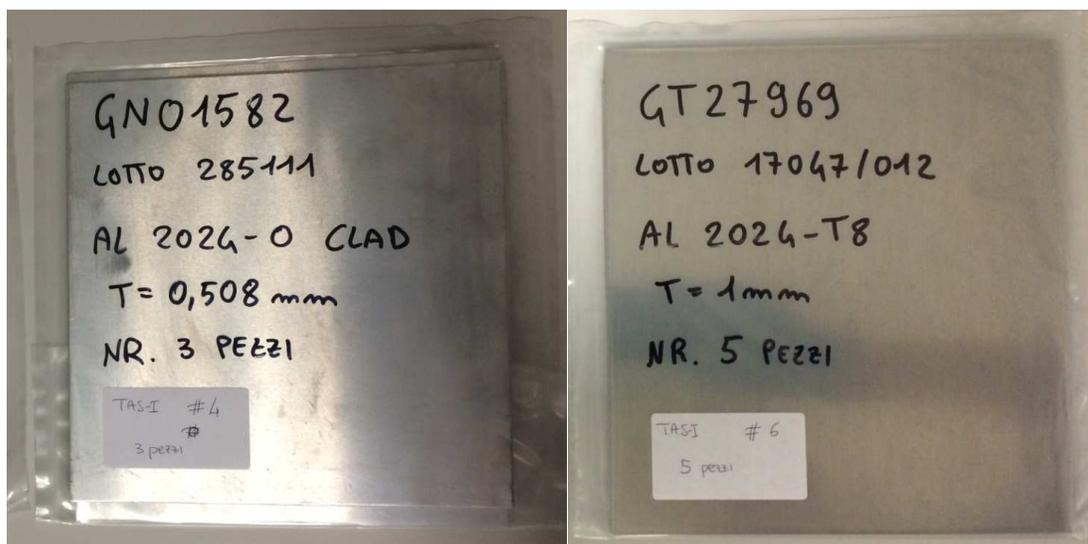


Figure 2-3: Test samples #4 and #6, Al2024 panels of different thicknesses

Aluminum 2024 composition is given here below, in weight percentages.

Al 2024				
Al	Si	Fe	Cu	Mn
92.4	0.5	0.5	4	0.6
Mg	Cr	Ni	Zn	Ti
1.5	0.1	0	0.25	0.15

2.1.3.1 Safety Issue

Sharp edges, handle with care.

2.1.4 CFRP panels

Carbon fiber–reinforced plastic (CFRP, or often simply carbon fiber) is an extremely strong and light fiber-reinforced plastic which contains carbon fibers.

They can be expensive to produce but are used wherever high strength-to-weight ratio and rigidity are required.

They could be used instead of Aluminum as primary structure in a spacecraft, and in the framework of this project it is interesting to study the differences in radiation shielding capability of these two options.

The CFRP panels were made in the production department of Thales Alenia Space Italia, Torino, using carbon fiber and impregnate them it in Hexcel resins.

2 pieces of 0.6 mm of thickness and 2 of 1 mm are provided, in order to be able to test multilayered configurations.

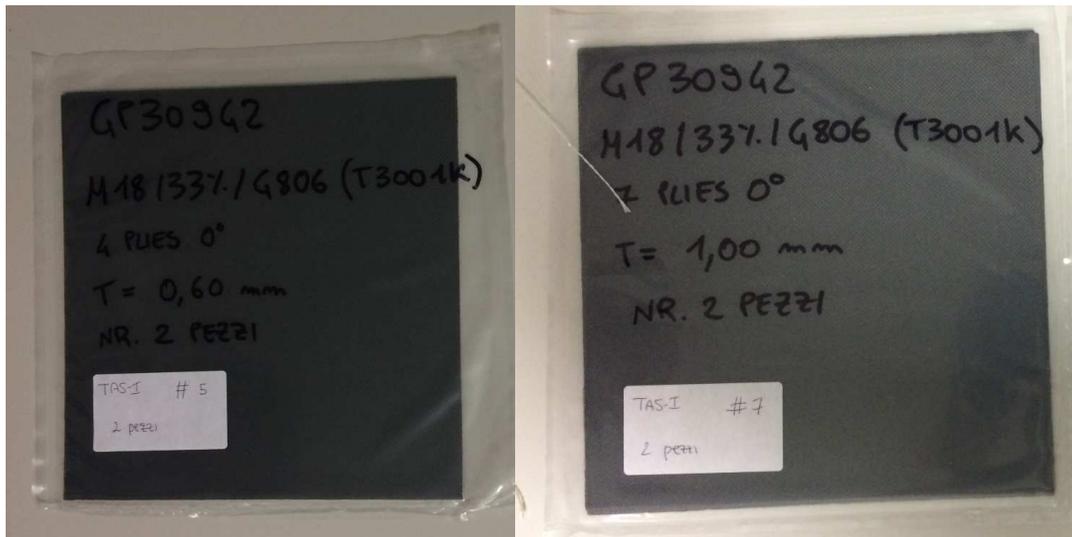


Figure 2-4: Test samples #5 and #7, CFRP panels of different thicknesses

Sample Number	Description / Code	Material Name	x [mm]	y [mm]	z [mm]	Density [g/cm ³]	Aeric Density [g/cm ²]
5	GP3092	T3001k	200	200	0.6	1.5	0.0900
7	GP30942	T3001k	200	200	1	1.5	0.1500

2.1.4.1 Safety Issue

Sharp edges, handle with care, using gloves.

See attached Safety Datasheet for the initial carbon fiber and epoxy materials, applicable in case the material is broken and some dust is freed.

THALES ALENIA SPACE CONFIDENTIAL

2.1.5 Kevlar Resins MDPS

The Kevlar-Resin plates are made of 18 layers of Kevlar fabric 129, style 812 (0.028 g/cm² per layer), plus CIBA 914 Epoxy Resin, having an impregnation mass percentage in the range from 30 to 38% of total composite mass.

Kevlar® is a material extensively used for the design and manufacturing of the shields protecting the manned elements of the International Space Station (ISS) from the threat posed by meteoroids and space debris that increasingly pollute the Earth orbits .

Kevlar (poly(p-phenylene terephthalamide) - PPTA) is an organic fiber (patented by DuPont) in aromatic polyamide family designated as aramid fibres.



Figure 2-5: test sample #8, 18 kevlar layer in epoxy resins

The chemical composition and the correspondent elemental weight fractions are reported hereafter.

Material Name	Chemical Formula	Element [txt]	Weight fraction [%]
Kevlar	C14-N2-O2-H10	C	70.58%
		N	11.76%
		O	13.43%
		H	4.23%

2.1.5.1 Safety Issue

None

2.1.6 PSU

PSU is a material characterized by high thermal and mechanical capacity, high impact strength, the ability to be flame retardant and with a good chemical and radiation resistance. It can be used both as internal outfitting in spacecraft, also with structural properties and, consequently treated, can be used as window materials.

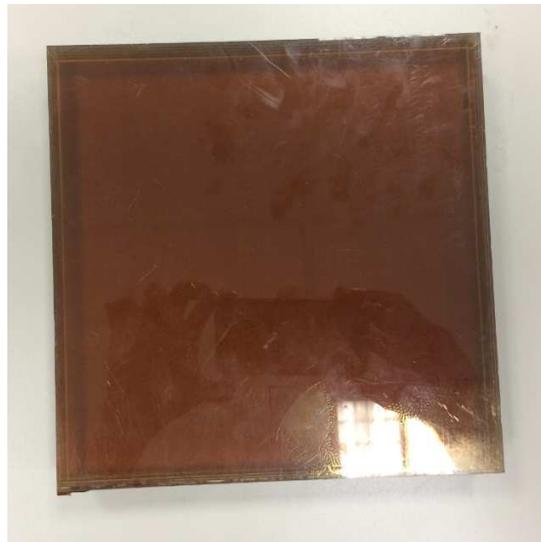


Figure 2-6: PSU test sample #9

Its chemical designation is Polyphenylsulfone, the DIN-Abbreviation is PPSU.

#	Description / Code	Material name	x [mm]	y [mm]	z [mm]	Density [g/cm ³]	Aeric Density [g/cm ²]
9	PPSU	Polyphenylsulfon	192	192	31	1.2900	3.9990

2.1.6.1 Safety Issue

None

THALES ALENIA SPACE CONFIDENTIAL

2.1.7 Nextel MDPS

Reinforcement Fiber used in the Meteoroids and Debris Protection System (MDPS) of typical spacecraft.

Nextel textiles meet space standard requirements such as abrasion resistance, high thermal insulation properties, good thermal mechanical properties, high electrical resistance at elevated temperature.

In space they are used as micrometeorite shield is for impact protection from outerspace debris, door seals, shuttle tiles, and many others.

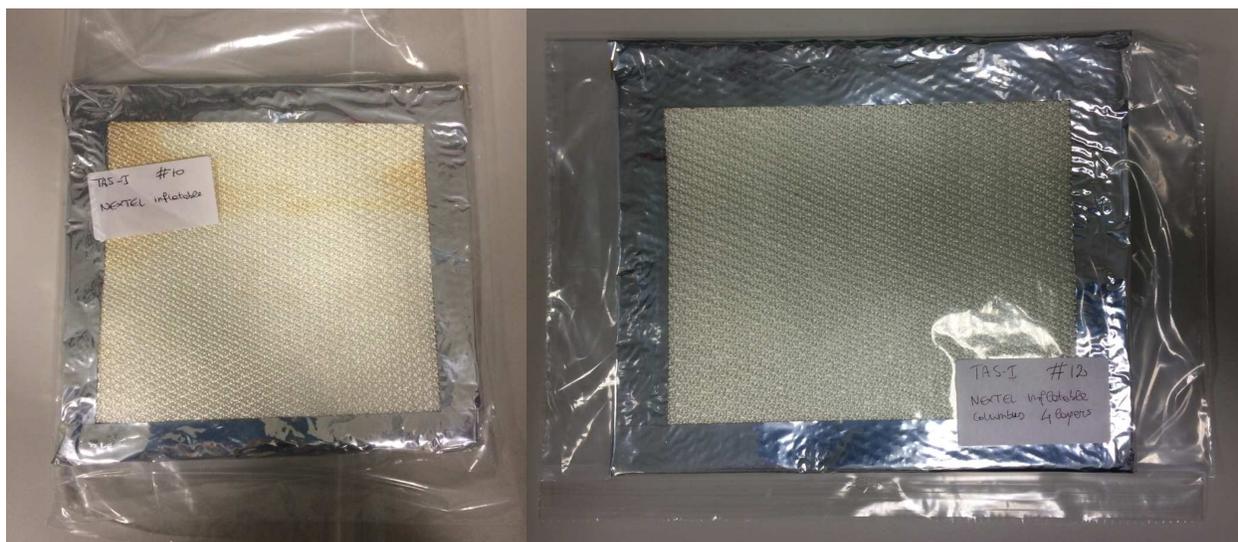


Figure 2-7: 2 nextel test samples

Nextel chemical composition	
Al ₂ O ₃	62.5 %
SiO ₂	24.5 %
B ₂ O ₃	13 %

Material Name	Element [txt]	Weight fraction [%]
Nextel 312	Al	32.6
	Si	11.3
	B	4.3
	O	51.6

2.1.7.1 Safety Issue

Carefully read the safety data sheet [RD4] for information, reported here in Annex 1, at page 16. Samples must be handled with gloves. Do not cut the samples to avoid dust dispersion.

THALES ALENIA SPACE CONFIDENTIAL

2.1.8 Inflatable MDPS Kevlar+Bladder

This sample is characteristic of the internal layer found in inflatable habitats. In particular it is made of two different layer:

- A Kevlar fabric style 312 0.0280 g/cm², which will face the inside of the habitat, in direct contact with air
- A Coretech® CBRN (brown) layer, thick 0.668mm, and composed by PU / PTFE / PU layer, as shown Figure 2-9. The majority of the bladder can be thought of made by PU (about 0.6 mm) and in the simulation the PTFE layer can be ignored. This layer is water repellent and is guaranteeing the insulation.



Figure 2-8: Test sample of an inflatable module internal layer

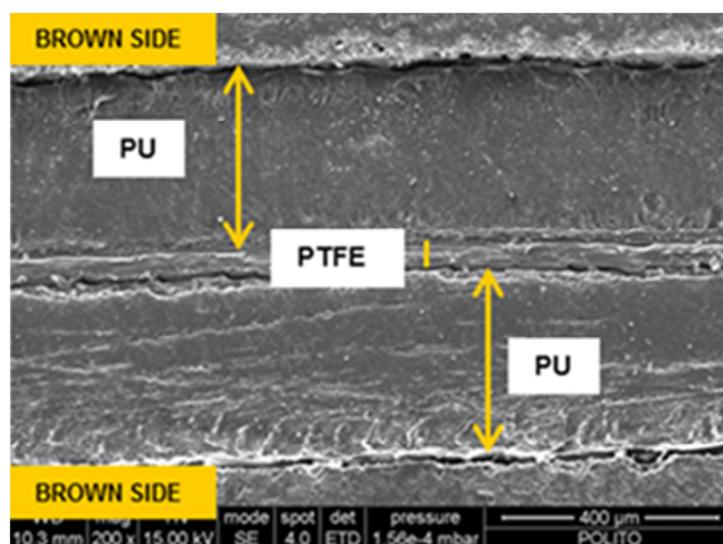


Figure 2-9: Bladder PU / PTFE / PU layers (courtesy of STEP2 project)

THALES ALENIA SPACE CONFIDENTIAL

Material Name	Chemical Formula	Element [txt]	Weight fraction [%]
Kevlar	C14-N2-O2-H10	C	70.58%
		N	11.76%
		O	13.43%
		H	4.23%
Coretech® CBRN	PU / PTFE / PU	-	-

2.1.8.1 Safety Issue

None.

No not cut the samples to avoid dispersions of Kevlar fabric dust.

2.1.9 VECTRAN fibers

Vectran's golden fibers are noted for their thermal stability at high temperatures, high strength and modulus, low creep, and good chemical stability.

Vectran fibers are used as reinforcing fibers for ropes, cables, sailcloth and advanced composite materials. Vectran is used as one of the layers in the softgoods structure of NASA's Extravehicular Mobility Unit (spacesuit) and was the fabric used for all of the airbag landings on Mars.

Vectran will be a key component in future inflatable structures for space.

Density of the fiber is 1.4 g/cm³.

Information on the aeric density of the samples will be sent when available and this TN will be updated accordingly.

THALES ALENIA SPACE CONFIDENTIAL

3. TEST CONFIGURATION

To be written

High resistance Advanced Shields (AS) composed of an external aluminum bumper and an intermediate Nextel-Kevlar epoxy panel (for the areas most exposed to the debris environment).

THALES ALENIA SPACE CONFIDENTIAL

APPENDICES : Nextel Safety Datasheet

3M™ Nextel™ Fiber 312 and 440 10/28/14



Safety Data Sheet

Copyright, 2014, 3M Company.

All rights reserved. Copying and/or downloading of this information for the purpose of properly utilizing 3M products is allowed provided that: (1) the information is copied in full with no changes unless prior written agreement is obtained from 3M, and (2) neither the copy nor the original is resold or otherwise distributed with the intention of earning a profit thereon.

This Safety Data Sheet (SDS) is provided as a courtesy in response to a customer request. This product is not regulated under, and a SDS is not required for this product by the OSHA Hazard Communication Standard (29 CFR 1910.1200) because, when used as recommended or under ordinary conditions, it should not present a health and safety hazard. However, use or processing of the product not in accordance with the product's recommendations or not under ordinary conditions may affect the performance of the product and may present potential health and safety hazards.

Document Group:	10-9903-5	Version Number:	27.01
Issue Date:	10/28/14	Supersedes Date:	07/25/14

SECTION 1: Identification

1.1. Product identifier

3M™ Nextel™ Fiber 312 and 440

1.2. Recommended use and restrictions on use

Recommended use
Reinforcement Fiber

1.3. Supplier's details

MANUFACTURER:	3M
DIVISION:	Advanced Materials Division
ADDRESS:	3M Center, St. Paul, MN 55144-1000, USA
Telephone:	1-888-3M HELPS (1-888-364-3577)

1.4. Emergency telephone number

1-800-364-3577 or (651) 737-6501 (24 hours)

SECTION 2: Hazard identification

2.1. Hazard classification

This product is exempt from hazard classification according to OSHA Hazard Communication Standard, 29 CFR 1910.1200.

2.2. Label elements

Signal word
Not applicable.

Symbols
Not applicable.

Pictograms
Not applicable.

2.3. Hazards not otherwise classified
None.

SECTION 3: Composition/information on ingredients

Ingredient	C.A.S. No.	% by Wt
Aluminoborosilicate Fibers	12788-79-3	100

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation:

Remove person to fresh air. If you feel unwell, get medical attention.

Skin Contact:

Wash with soap and water. If signs/symptoms develop, get medical attention.

Eye Contact:

Flush with large amounts of water. Remove contact lenses if easy to do. Continue rinsing. If signs/symptoms persist, get medical attention.

If Swallowed:

Rinse mouth. If you feel unwell, get medical attention.

4.2. Most important symptoms and effects, both acute and delayed

See Section 11.1. Information on toxicological effects.

4.3. Indication of any immediate medical attention and special treatment required

Not applicable

SECTION 5: Fire-fighting measures

5.1. Suitable extinguishing media

Material will not burn. Non-combustible. Use a fire fighting agent suitable for surrounding fire.

5.2. Special hazards arising from the substance or mixture

None inherent in this product.

5.3. Special protective actions for fire-fighters

No special protective actions for fire-fighters are anticipated.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Ventilate the area with fresh air. Observe precautions from other sections.

6.2. Environmental precautions

Avoid release to the environment.

6.3. Methods and material for containment and cleaning up

Not applicable. Use wet sweeping compound or water to avoid dusting. Sweep up. Seal the container.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Avoid skin contact with hot material. Avoid breathing of dust created by cutting, sanding, grinding or machining. This product is considered to be an article which does not release or otherwise result in exposure to a hazardous chemical under normal use conditions. Avoid breathing dust/fume/gas/mist/vapors/spray. Do not eat, drink or smoke when using this product. Wash thoroughly after handling.

7.2. Conditions for safe storage including any incompatibilities

Not applicable.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

No occupational exposure limit values exist for any of the components listed in Section 3 of this SDS.

8.2. Exposure controls

8.2.1. Engineering controls

No engineering controls required.

8.2.2. Personal protective equipment (PPE)

Eye/face protection

Select and use eye/face protection to prevent contact based on the results of an exposure assessment. The following eye/face protection(s) are recommended:

Safety Glasses with side shields

Skin/hand protection

Select and use gloves and/or protective clothing approved to relevant local standards to prevent skin contact based on the results of an exposure assessment. Selection should be based on use factors such as exposure levels, concentration of the substance or mixture, frequency and duration, physical challenges such as temperature extremes, and other use conditions. Consult with your glove and/or protective clothing manufacturer for selection of appropriate compatible gloves/protective clothing.

Gloves made from the following material(s) are recommended: Neoprene

Nitrile Rubber

Respiratory protection

During grinding, scraping, sanding:

An exposure assessment may be needed to decide if a respirator is required. If a respirator is needed, use respirators as part of a full respiratory protection program. Based on the results of the exposure assessment, select from the following respirator type(s) to reduce inhalation exposure:

Half facepiece or full facepiece air-purifying respirator suitable for particulates

For questions about suitability for a specific application, consult with your respirator manufacturer.

Thermal hazards

Wear heat insulating gloves when handling hot material to prevent thermal burns.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

General Physical Form:	Solid
Specific Physical Form:	Fine Fibers
Odor, Color, Grade:	shiny thread or yarn, white fiber, odorless.
Odor threshold	<i>Not Applicable</i>
pH	<i>Not Applicable</i>
Melting point	<i>Not Applicable</i>
Boiling Point	<i>Not Applicable</i>
Flash Point	<i>Not Applicable</i>
Evaporation rate	<i>Not Applicable</i>
Flammability (solid, gas)	Not Classified
Flammable Limits(LEL)	<i>Not Applicable</i>
Flammable Limits(UEL)	<i>Not Applicable</i>
Vapor Pressure	<i>Not Applicable</i>
Vapor Density	<i>Not Applicable</i>
Density	2.7 g/cm ³
Specific Gravity	2.7 [Ref Std: WATER=1]
Solubility in Water	Negligible
Solubility- non-water	<i>Not Applicable</i>
Partition coefficient: n-octanol/ water	<i>No Data Available</i>
Autoignition temperature	<i>Not Applicable</i>
Decomposition temperature	<i>Not Applicable</i>
Viscosity	<i>Not Applicable</i>
Volatile Organic Compounds	<i>Not Applicable</i>
Percent volatile	<i>Not Applicable</i>
VOC Less H ₂ O & Exempt Solvents	<i>Not Applicable</i>

SECTION 10: Stability and reactivity

10.1. Reactivity

This material is considered to be non reactive under normal use conditions.

10.2. Chemical stability

Stable.

10.3. Possibility of hazardous reactions

Hazardous polymerization will not occur.

10.4. Conditions to avoid

None known.

10.5. Incompatible materials

None known.

10.6. Hazardous decomposition products

<u>Substance</u>	<u>Condition</u>
None known.	

Under recommended usage conditions, hazardous decomposition products are not expected. Hazardous decomposition products may occur as a result of oxidation, heating, or reaction with another material.

SECTION 11: Toxicological information

The information below may not be consistent with the material classification in Section 2 if specific ingredient classifications are mandated by a competent authority. In addition, toxicological data on ingredients may not be reflected in the material classification and/or the signs and symptoms of exposure, because an ingredient may be present below the threshold for labeling, an ingredient may not be available for exposure, or the data may not be relevant to the material as a whole.

11.1. Information on Toxicological effects

Signs and Symptoms of Exposure

Based on test data and/or information on the components, this material may produce the following health effects:

Inhalation:

During grinding, scraping, sanding:

Respiratory Tract Irritation: Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.

Skin Contact:

Mechanical Skin irritation: Signs/symptoms may include abrasion, redness, pain, and itching.

Eye Contact:

Mechanical eye irritation: Signs/symptoms may include pain, redness, tearing and corneal abrasion.

Ingestion:

Physical Blockage: Signs/symptoms may include cramping, abdominal pain, and constipation.

Gastrointestinal Irritation: Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Target Organ Effects:

Due to their large size (7-15 microns in diameter), Nextel(TM) Ceramic Fibers do not meet the definition of respirable as defined by WHO convention and ECHA. Because Nextel fibers are considered non-respirable, they are not expected to pose a cancer risk.

Additional Information:

This product, when used under reasonable conditions and in accordance with the 3M directions for use, should not present a health hazard. However, use or processing of the product in a manner not in accordance with the product's directions for use may affect the performance of the product and may present potential health and safety hazards.

Due to their large size (7-15 microns in diameter), Nextel(TM) Ceramic Fibers do not meet the definition of respirable as defined by WHO convention and ECHA. Because Nextel fibers are considered non-respirable, they are not expected to pose a cancer risk.

Toxicological Data

If a component is disclosed in section 3 but does not appear in a table below, either no data are available for that endpoint or the data are not sufficient for classification.

Acute Toxicity

Name	Route	Species	Value
Overall product	Ingestion		No data available; calculated ATE > 5,000 mg/kg

ATE = acute toxicity estimate

Skin Corrosion/Irritation

Name	Species	Value
------	---------	-------

Serious Eye Damage/Irritation

Name	Species	Value
------	---------	-------

Skin Sensitization

Name	Species	Value
------	---------	-------

Respiratory Sensitization

Name	Species	Value
------	---------	-------

Germ Cell Mutagenicity

Name	Route	Value
------	-------	-------

Carcinogenicity

Name	Route	Species	Value
------	-------	---------	-------

Reproductive Toxicity

Reproductive and/or Developmental Effects

Name	Route	Value	Species	Test Result	Exposure Duration
------	-------	-------	---------	-------------	-------------------

Target Organ(s)

Specific Target Organ Toxicity - single exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
------	-------	-----------------	-------	---------	-------------	-------------------

Specific Target Organ Toxicity - repeated exposure

Name	Route	Target Organ(s)	Value	Species	Test Result	Exposure Duration
------	-------	-----------------	-------	---------	-------------	-------------------

Aspiration Hazard

Name	Value
------	-------

Please contact the address or phone number listed on the first page of the SDS for additional toxicological information on this material and/or its components.

SECTION 12: Ecological information

Ecotoxicological information

Please contact the address or phone number listed on the first page of the SDS for additional ecotoxicological information on this material and/or its components.

Chemical fate information

Please contact the address or phone number listed on the first page of the SDS for additional chemical fate information on this material and/or its components.

SECTION 13: Disposal considerations

13.1. Disposal methods

Dispose of contents/ container in accordance with the local/regional/national/international regulations.

Prior to disposal, consult all applicable authorities and regulations to insure proper classification. Dispose of waste product in

a permitted industrial waste facility. If no other disposal options are available, waste product may be placed in a landfill properly designed for industrial waste.

EPA Hazardous Waste Number (RCRA): Not regulated

SECTION 14: Transport Information

For Transport Information, please visit <http://3M.com/Transportinfo> or call 1-800-364-3577 or 651-737-6501.

SECTION 15: Regulatory information

15.1. US Federal Regulations

Contact 3M for more information.

311/312 Hazard Categories:

Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No Immediate Hazard - No Delayed Hazard - No

15.2. State Regulations

Contact 3M for more information.

15.3. Chemical Inventories

This product is an article as defined by TSCA regulations, and is exempt from TSCA Inventory listing requirements.

Contact 3M for more information.

15.4. International Regulations

Contact 3M for more information.

This SDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: Other information

NFPA Hazard Classification

Health: 0 Flammability: 0 Instability: 0 Special Hazards: None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

HMIS Hazard Classification

Health: 0 Flammability: 0 Physical Hazard: 0 Personal Protection: X - See PPE section.

Hazardous Material Identification System (HMIS® III) hazard ratings are designed to inform employees of chemical hazards in the workplace. These ratings are based on the inherent properties of the material under expected conditions of normal use and are not intended for use in emergency situations. HMIS® III ratings are to be used with a fully implemented HMIS® III program. HMIS® is a registered mark of the American Coatings Association (ACA).

Document Group: 10-9903-5
Issue Date: 10/28/14

Version Number: 27.01
Supersedes Date: 07/25/14

DISCLAIMER: The information in this Safety Data Sheet (SDS) is believed to be correct as of the date issued. 3M MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of use or application. Given the variety of factors that can affect the use and application of a 3M product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for user's method of use or application.

3M provides information in electronic form as a service to its customers. Due to the remote possibility that electronic transfer may have resulted in errors, omissions or alterations in this information, 3M makes no representations as to its completeness or accuracy. In addition, information obtained from a database may not be as current as the information in the SDS available directly from 3M

3M USA SDSs are available at www.3M.com

APPENDICES : Test Samples List

Sample Number	Description / Code	Material Name	x [mm]	y [mm]	z [mm]	Density [g/cm ³]	Aeric Density [g/cm ²]	Safety issues
1	GE27261	Al 5056	200	200	57	2.64	Only of Al	Sharp edges
2	GT30570	Al 5056	200	200	60	2.64	Only of Al	Sharp edges
3	Zotek F30	Zotek F30	200	200	25.4	0.03	0.0762	None
4	GN01582	Al 2024-0 clad	200	200	0.508	2.78	0.1412	None
5	GP3092	T3001k	200	200	0.6	1.5	0.0900	Handle with gloves
6	GT27969	Al 2024-T8	200	200	1	2.78	0.2780	None
7	GP30942	T3001k	200	200	1	1.5	0.1500	Handle with gloves
8	18 kevlar layer in epoxy resins	Kevlar Resins	300	300	6	1.1667	0.7000	None
9	PPSU	Polyphenylsulfon	192	192	31	1.2900	3.9990	None
10	Nextel 8 layers	Nextel 8	150	150	7	1.1429	0.8000	Handle with gloves
11	Inflatable Kevlar+Bladder	Kevlar layer PU / PTFE / PU	300 300	300 300	- 0.668	- -	0.0280 -	None None
12	Nextel 4 layers	Nextel 4	150	190	3.5	1.1429	0.4000	Handle with gloves
13	VECTRAN	VECTRAN	-	-	-	-	-	Handle with gloves

THALES ALENIA SPACE CONFIDENTIAL

Sample Number	Material Name	Note
1	Al 5056	AMS-C-7438 average honecomb density 3.1 lb/ft3 , 0.04966 g/cm3
2	Al 5056	AMS-C-7438 average honecomb density 4.5 lb/ft3 , 0.07208 g/cm3
3	Zotek F30	Density of 1.9 pcf
4	Al 2024-0 clad	3 pieces
5	T3001k	2 pieces of Hexcel resin + carbon fiber
6	Al 2024-T8	5 pieces
7	T3001k	2 pieces of Hexcel resin + carbon fiber
8	Kevlar Resins	The Kevlar-Resin plates are made of Kevlar fabric 129, style 812 (0.028 g/cm2 per layer), plus CIBA 914 Epoxy Resin, having an impregnation mass percentage in the range from 30 to 38% of total composite mass
9	Polyphenylsulfon	RADEL type
10	Nextel 8	The Nextel fabric is AF-62, style 312 (0.1 g/cm2 per layer).
11	Kevlar layer	Kevlar fabric 129, style 812. Check on aeric density with measurements
12	PU / PTFE / PU	Coretech® CBRN (brown) , PU / PTFE / PU layers, about 0.6 mm of PU and 0.068 mm of PTFE
13	Nextel 4	The Nextel fabric is AF-62, style 312 (0.1 g/cm2 per layer).
	VECTRAN	TBD

THALES ALENIA SPACE CONFIDENTIAL

END OF DOCUMENT

THALES ALENIA SPACE CONFIDENTIAL