

SAFETY DATA SHEET (SDS)

ACCORDING TO REGULATION (EC) NO. 1907/2006

PRODUCT NAME : REFRACTORY CERAMIC FIBRES (RCF) WITHIN COMBUSTOR LINERS

SECTION 1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/ UNDERTAKING

1.1 Product identifier

Product name: TPU (Thermal Processing Units), TCS (Thermal Conditioning System)
Combustor Liners

Other means of identification: None.

Item numbers by Product: A554-01-054 (24 inch Combustor Liner), A554-05-001 (12 inch Combustor Liner),
Y04210309 (12 inch HT Combustor Liner),
Y04210517 (12 inch HTA Combustor Liner Spare),
Y04210590 (6 inch HT Combustor Liner Spare),
Y35201093 (6 inch x 7 inch HTA Combustor Liner Spare),
Y35631229 (Burner Liner 3 inch x 6 inch HT (Included in Y35531431 3 inch x 6 inch
Combustor Assembly)),
Y35631011 (Burner Liner 3 inch x 7 inch HT (Included in Y35531236 3 inch x 7 inch
Combustor Assembly)),
Y04 - TPU, Y07 - TCS, Y09 - MOCVD Zenith, Y12 - Helios, Y22 - Zenith (Mk1 - Mk4),
Y28 - Kronis, Y35 - Atlas (Mk1 - Mk3b), Y45 - Atlas (Mk4), Y49 - EZenith, Y50 - iAtlas,
Y57 - Integrated WESP Atlas.

Identified use: Relevant identified uses of the substance or mixture and uses advised against
Only to be used in Edwards abatement equipment as indicated by the relevant part
number.

1.2 Details of the supplier of the safety data sheet.

UK contact details

Edwards, Innovation Drive, Burgess Hill, West Sussex,
RH15 9TW, United Kingdom

General enquiries

Tel: +44 (0)8459 212223

Email: info@edwardsvacuum.com

US contact details

Edwards, 6416 Inducon Drive West, Sanborn,
New York, 14132, USA

General enquiries

Toll Free: 1-800-848-9800

1.3 Emergency telephone number

Chemtrec: 1-800-424-9300

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SECTION 2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS classification: Mixture.

Classification according to Regulation (EC) No. 1272/2008: RCF have been classified as a 1B carcinogen (presumed to have carcinogenic potential for humans, largely based on animal evidence).

2.2 Label elements

Hazard pictograms:



Signal words: Danger.

Hazard statements: May cause cancer by inhalation (H350i).

Precautionary statements: Do not handle until all safety instructions have been read and understood (P202).
Use personal protective equipment as required (P281).

2.3 Other hazards

PBT criteria: No data available.

vPvB criteria: No data available.

Other hazards which do not result in a classification: Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure. These effects are usually temporary.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Not applicable

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3.2 Mixtures

Ingredient	% Weight	CAS No	Hazard class*	Risk phrase / Hazard Statements*
Aluminosilicate Refractory Ceramic Fibres **	50 - 67	142844-00-6	1B Carcinogen	H350i P202 P281
Non-hazardous metal alloy fibres	33 - 50	Not applicable	Not applicable	Not applicable

*Hazard class, Risk phrase and Hazard Statements. These columns are only completed for ingredients which are classified as hazardous under EU Directive No 1272/2008 (as amended) and are present in sufficient concentration to make the overall substance hazardous. In all other situations, the column will be completed as "Not applicable".

Full text for the declared risk phrases and hazards statements is given in Section 16.

** Chemical Composition. RCF has a chemical composition of SiO₂ 45-60% - Al₂O₃ 40-55%.

SECTION 4. FIRST AID MEASURES

4.1 Description of first aid measures

Eyes:	Immediately flush eyes with plenty of water. Do not rub eyes. Ensure an eye bath is available. Seek medical attention if symptoms persist.
Skin:	Remove any contaminated clothing. Rinse skin with plenty of water, washing gently. Do not rub or scratch exposed skin. Seek medical attention if symptoms persist.
Ingestion/Oral:	If swallowed, move to a dust-free environment and give plenty of water to drink. Seek medical attention if symptoms persist.
Inhalation:	If inhaled, move to a dust-free environment and give plenty of water to drink and blow nose. Seek medical attention if symptoms persist.
General advice:	None.

4.2 Most important symptoms and effect, both acute and delayed

Potential acute health effects:

Eyes:	Exposure may cause mild mechanical irritation. This is usually temporary.
Skin:	Exposure may cause mild mechanical irritation. This is usually temporary.
Ingestion / Oral:	No data available.
Inhalation:	Exposure may cause mild mechanical irritation to upper respiratory system. This is usually temporary.

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Over-exposure symptoms:

Eyes:	No data available.
Skin:	No data available.
Ingestion / Oral:	No data available.
Inhalation:	No data available.

4.3 Indication of any immediate medical attention and special treatment needed

No data available.

SECTION 5. FIRE FIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media:	Use extinguishing media suitable for the surrounding fire.
Unsuitable extinguishing media:	Not applicable.

5.2 Special hazards arising from the substance or mixture

Fire and explosion hazard:	None. The product is not combustible.
Hazardous combustion products	No data available.

5.3 Advice for fire-fighters

Special precautions for fire-fighters:	None.
Special protective equipment for fire-fighters:	None.

For Flammability Properties - refer to Section 9.

SECTION 6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel:	Where abnormally high dust concentrations occur, evacuate non-essential staff, or those not equipped with individual protection apparatus. Avoid inhalation and contact with skin and eyes.
For emergency responders:	No data available.

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6.2 Environmental precautions:

Prevent dispersion of dust by dampening product or by other means of containment. Do not flush into surface water or sanitary sewer system.

6.3 Methods and material for containment and cleaning up

Put on the necessary personal protective clothing: see Section 8. Where possible, pick up large pieces and use a Vacuum Cleaner fitted with a high efficiency filter (HEPA) to clean-up the remaining product. If brushing is used, ensure product is wetted before commencing. Never use compressed air to clean-up product and, wherever possible, prevent the product from being wind blown. Dispose of according to applicable local, state and federal regulations.

6.4 Reference to other sections

Refer to Section 8 for information on personal protective equipment.

Refer to Section 13 for information on disposal considerations.

SECTION 7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Handling of the product should be limited as this can be a source of dust emission. Wherever possible, processes should be designed to limit handling and, where practical, carried out under controlled conditions, for example, using dust exhaust systems. Limit the use of power tools unless in conjunction with local exhaust ventilation. Use hand tools whenever possible.

Ensure Personal Protective Equipment is used whenever handling the product, see Section 8. Practice good housekeeping to minimise secondary dust dispersal.

7.2 Conditions for safe storage, including any incompatibilities

Store in original packaging in a dry, cool area. Ensure all packaging and containers are clearly labelled and sealed when not in use. Take precautions to prevent dust emissions and dispersion while removing or replacing the packaging. Empty packaging and containers must be cleaned prior to disposal as recommended in Section 6.

7.3 Specific end use(s)

Only to be used by professional users as thermal insulation, heat shields, heat containment, gaskets and expansion joints at temperatures up to 1250 °C (2282 °F) in industrial equipment.

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SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Ingredient	ACGIH - TLV	OSHA - PEL	Occupational Exposure Limits EH40 (UK)
RCF	0.2 f/cc - 8 hr TWA	*	5 mg.m ⁻³ 1 fibre/millilitre

* Except for the state of California, where PEL for RCF is 0.2 f/cc 8-hr TWA, there is no specific regulatory standard for RCF in the U.S. OSHA's "Particulate Not Otherwise Regulated (PNOR)" standard [29 CFR 1910.1000, Subpart Z, Air Contaminants] applies generally; Total Dust 15 mg/m³; Respirable Fraction 5 mg/m³.

Other Occupational Exposure Levels (OEL)

Australia	0.5 f/ml *
Belgium	0.5 f/ml *
Czech Republic	1.0 f/ml *
Denmark	1.0 f/ml *
Finland	0.2 f/ml *
France	0.1 f/ml *
Germany **	0.2 f/ml * (max. tolerance-concentration)
Italy	0.2 f/ml *
Poland	0.5 f/ml *
Spain	0.5 f/ml *
Sweden	0.2 f/ml *
The Netherlands	0.5 f/ml *
UK	1.0 f/ml *

* 8-hr Time Weighted Average (TWA) concentrations of airborne respirable fibres measured using the conventional membrane filter method.

** In Germany, OELs were replaced by concentration ranges following a risk based concept. The maximum "tolerance-concentration" is 0.2 f/ml following TRGS 558 in combination with BekGS 910.

The Scientific Committee on Occupation Exposure Limit Values (SCOEL) as set up by a Commission Decision (95/320/EC) have proposed an OEL for RCF of 0.3 f/ml.

Recommended Monitoring Programmes

France has a monitoring programme in line with test method reference number XP X43-269 dated March 2002, which is used to check for compliance with the OEL of 0.1 f/ml.

The UK follow MDHS 59 specific for MMVF: "Man-made mineral fibre - Airborne number concentration by phase-contrast light microscopy" and MDHS 14/3 "General methods for sampling and gravimetric analysis of respirable and inhalable dust".

Germany recommends following the rules as laid out in TRGS 402 and describes applicable sampling / analytical methods in BGI 505-31 and BGI 505-46.

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WHO-EURO method: Determination of airborne fibre number concentrations; A recommended method, by phase-contrast optical microscopy (membrane filter method); World Health Organisation Geneva 1997 ISBN 92 4 154496 1.

DNEL/DMEL

The calculation of DMELs for fibres alone is not possible; a precautionary value is assigned based on fibrosis. An inhalation DMEL of 0.5 mg/m^3 with an assessment factor of 25 can be calculated based on repeated dose toxicity, this value in the correct units would give a DMEL of 4 f/ml.

8.2 Exposure controls

Appropriate engineering controls: Ensure adequate ventilation, especially in confined areas. Designate work areas and restrict access to informed and trained personnel. Ensure operating procedures and processes limit production of dust and exposure of personnel.

Individual protection measures:

Eye/Face Protection: Wear safety goggles or glasses with side shields.

Hand/Skin Protection: If working with virgin material, wear industrial leather gloves and work clothes, which are loose fitting at the neck and wrist.

Respiratory Protection: Where dust concentrations are below the OEL, no Respiratory Protection Equipment (RPE) is required but FFP2 Respirators may be used on a voluntary basis.

For short term procedures where exposure to dust concentrations is less than ten times the OEL, FFP3 Respirators must be used.

If the dust concentration is unknown or particularly high, advice must be sought from an Industrial Hygienist or a suitable professional body such as ECFIA.

Hygiene Measures: Ensure soiled clothes are cleaned to remove excess dust prior to removal using a suitable vacuum cleaner fitted with a HEPA filter. Personnel should be provided with two separate lockers or equivalent to prevent cross-contamination of work/non-work clothing. Work clothing must not be laundered with non-work clothes.

Other/General Protection: None.

Environmental exposure controls:

Processes involving the manufacturing or use of RCF should be filtered to minimise fibre emissions to air.

Waste RCF should be stored in closed containers and placed in to deep landfills.

General good practice is to ensure waste and spills are prevented from being wind blown by covering and damping. Do not flush into surface water or the sanitary sewer system.

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SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance	White solid	Melting point / freezing point	> 1650 / 3002	°C / °F
Odour	None	Initial boiling point and boiling range	Not applicable	°C / °F
Odour threshold	Not applicable	Flash point	Not applicable	°C / °F
pH	Not applicable	Upper/lower flammability or explosive limits	Not applicable	°C / °F
Evaporation rate	Not available	Vapour pressure	Not applicable	mbar / Torr
Flammability (solid, gas)	Not applicable	Vapour density	Not applicable	g/cm ³
Solubility(ies)	< 1 mg/l	Relative density	2.5 - 2.75	g/cm ³
Partition coefficient: n-octanol/water	Not applicable	Auto-ignition temperature	Not applicable	°C / °F
Explosive properties	Not applicable	Decomposition temperature	Not applicable	°C / °F
Oxidising properties	Not applicable	Viscosity	Not available	cSt

9.2 Other information

The length weighted geometric mean diameter of fibres contained in the products is 1.4 - 3 µm. These fibres are dense materials and so will settle rapidly from both air and liquid.

SECTION 10. STABILITY AND REACTIVITY

10.1 Reactivity

Non-reactive.

10.2 Chemical stability

Inorganic, stable and inert.

10.3 Possibility of hazardous reactions

None.

10.4 Conditions to avoid

Processes or actions that generate or disperse dust. Refer to Section 7.

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10.5 Incompatible materials

None.

10.6 Hazardous decomposition products

Upon heating above 900 °C for sustained periods, this amorphous material can begin to transform to mixtures of crystalline phases.

SECTION 11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity:	No data available.
Irritation:	No evidence found to indicate skin or respiratory irritation except mechanical irritation.
Corrosivity:	No data available.
Sensitisation:	No evidence of respiratory or skin sensitisation potential.
Repeat dose toxicity:	No data available.
Carcinogenicity:	<p>Method: Inhalation. Multi-dose Species: Rat Dose: 3 mg/m³, 9 mg/m³ and 16 mg/m³ Routes of administration: Nose only inhalation Results: Fibrosis just reached significant levels at 16 and 9 mg/m³ but not at 3 mg/m³. None of the parenchymal tumour incidences were higher than the historical control values for this strain of animal.</p> <p>Method: Inhalation. Single dose Species: Rat Dose: 30 mg/m³ Routes of administration: Nose only inhalation Results: This study was designed to test the chronic toxicity and carcinogenicity of RCF at extreme exposures. Tumour incidence (including mesothelioma) was raised at this dose level. The presence of overload conditions (only detected after the experiment was completed), whereby the delivered dose exceeded the clearance capability of the lung, makes meaningful conclusions in terms of hazard risk assessment difficult.</p>

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Method: Inhalation. Single dose
Species: Hamster
Dose: 30 mg/m³
Routes of administration: Nose only inhalation
Results: This low quality study in Hamsters (no justification for exposure concentration used and pre existing and concurrent infections in the test animals) produced mesothelial lesions of uncertain significance. Subsequent studies in hamsters with glass fibres indicated that the lung burdens of RCF in this experiment were between 5 and 10 times more than that needed to produce overload, and the results are therefore difficult to interpret.

There are reports of injection studies with some similar materials. While some intraperitoneal injection (IP) studies reported the development of tumours in rats, the relationship of these results to classification remains controversial.

Mutagenicity: Method: In vitro micronucleus test
Species: Hamster (CHO)
Dose: 1-35 mg/m³
Routes of administration: In suspension
Results: Negative

Specific Target Organ Toxicity (STOT) - single exposure Not applicable.

STOT - repeated exposure Not applicable.

Aspiration hazard Not applicable.

Toxicity for reproduction: Method: Gavage
Species: Rat
Dose: 250 mg/kg/day
Routes of administration: Oral
Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibres. Exposure to these fibres is via inhalation and effects seen are in the lung. Clearance of fibres is via the gut and the faeces, so exposure of the reproductive organs is extremely unlikely.

Information on likely routes of exposure

Inhalation or ingestion.

Symptoms related to the physical, chemical and toxicological characteristics

Eye Effects: Exposure may cause mild mechanical irritation. This is usually temporary.

Skin Effects: Exposure may cause mild mechanical irritation. This is usually temporary.

Ingestion/Oral Effects: No data available.

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Inhalation Effects: Exposure may cause mild mechanical irritation to upper respiratory system. This is usually temporary.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

No data available.

Other information

Pre-existing medical conditions including dermatitis, asthma or chronic lung disease may be aggravated by exposure. Individuals who have a history of allergies may experience greater amounts of skin and respiratory irritation.

SECTION 12. ECOLOGICAL INFORMATION

There are no known incidents of ecological damage, nor would be this be expected in normal use.

12.1 Toxicity

No known aquatic toxicity.

12.2 Persistence and degradability

These products are insoluble materials that remain stable over time and are chemically identical to inorganic compounds found in the soil and sediment; they remain inert in the natural environment.

12.3 Bioaccumulative potential

No bioaccumulative potential.

12.4 Mobility in soil

No mobility in soil.

12.5 Results of PBT and vPvB assessment

PBT: Not applicable.

vPvB: Not applicable.

12.6 Other adverse effects

Environmental fate and distribution

No known adverse effects.

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SECTION 13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product: Waste containing > 0.1% RCF is categorised as a stable, non-reactive hazardous waste, which can generally be disposed of at landfill sites licensed for this purpose. Unless wetted, waste generates dust. To avoid dispersion of dust, waste should be properly sealed in clearly labelled containers for disposal. Disposal of this product should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. When disposing of waste and assigning a European Waste Code (EWC), any possible contamination during use must be considered by a suitably qualified individual.

Packaging: No data available.

SECTION 14. TRANSPORT INFORMATION

14.1 UN number

ADR/RID	IMDG	IATA	United States DOT
Not applicable	Not applicable	Not applicable	Not applicable

14.2 UN proper shipping name

ADR/RID	IMDG	IATA	United States DOT
Not applicable	Not applicable	Not applicable	Not applicable

14.3 Transport hazard class

ADR/RID	IMDG	IATA	United States DOT
Not applicable	Not applicable	Not applicable	Not applicable

14.4 Packing group

ADR/RID	IMDG	IATA	United States DOT
Not applicable	Not applicable	Not applicable	Not applicable

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14.5 Environmental hazards

ADR/RID	IMDG	IATA	United States DOT
Not applicable	Not applicable	Not applicable	Not applicable

14.6 Special precautions for user

ADR/RID	IMDG	IATA	United States DOT
Not applicable	Not applicable	Not applicable	Not applicable

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code

Not applicable.

SECTION 15. REGULATORY INFORMATION

15.1 Safety, health and environment regulations/legislation specific for the substance or mixture

European

This product has been classified in accordance with EU Regulation No 1272/2008 (as amended) on the Classification, Labelling and Packaging of Substances and Mixtures.

Classified as dangerous to supply: Not available

German Federal Water Management Act: Water contaminating class - No data available.

RCF are classified as a carcinogenic substance CLP 1B. On the 13th of January 2010 ECHA updated the Candidate List (containing Substances of Very High Concern (SVHC) - potentially qualifying for authorisation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibres and zirconia aluminosilicate refractory ceramic fibres.

United States

All components are on the U.S EPA TSCA inventory list.

SARA TITLE III - SECTION 313 SUPPLIER NOTIFICATION:

This product does not contain toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 and 40 CFR Part 372.

California Proposition 65: This product is a chemical known to the State of California to cause cancer or reproductive toxicity.

Canadian

WHMIS Classification: D2A.

All ingredients in this product are included in the Canadian DSL.

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15.2 Chemical safety assessment

No data available.

SECTION 16. OTHER INFORMATION

This SDS is compiled in accordance with OSHA HCS 2012, Regulation (EC) No 1907/2006 (as amended by Regulation No 453/2010) concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

16.1 Full text of abbreviated statements and phrases

H350i	May cause cancer by inhalation.
P202	Do not handle until all safety instructions have been read and understood.
P281	Use personal protection equipment as required.

16.2 NFPA / HMIS hazard codes

NFPA Hazard codes		HMIS Hazard codes		Rating System
Health	1	Health	1	0 = No Hazard
Flammability	0	Flammability	0	1 = Slight Hazard
Instability	0	Reactivity	0	2 = Moderate Hazard
				3 = Serious Hazard
				4 = Severe Hazard

16.3 Sources of information for this data sheet

- Unifrax Fiberfrax[®] Safety Data Sheet - European - SDS number 400E Revision 43, 6th February 2015.
- Unifrax Fiberfrax[®] Safety Data Sheet - North American - SDS number M0001, 12th February 2015

16.4 Registered products

Fiberfrax[®] is a registered product of Unifrax I LLC.

16.5 Glossary

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road; ANSI - American National Standards Institute; CAS - Chemical Abstracts Service; Chemtrec - Chemical Transportation Emergency Center (US); DMEL - Derived Minimum Effect Level; DNEL - Derived No Effect Level; DSL - Domestic Substances List; EH40 (UK) - HSE Guidance Note EH40 Occupational exposure limits; EPCRA - Emergency Planning and Community Right-to-Know Act; EWC - European Waste Code; GHS - Globally Harmonized System of Classification and Labelling of Chemicals; HMIS - Hazardous Material Information Service; IATA - International Air Transport Association; - International Bulk Chemical; IMDG - International Maritime Dangerous Goods; MARPOL 73/78 - International Convention for the Prevention of Pollution from Ships, 1973 as modified by the protocol of 1978; NFPA - National Fire Protection Association; OEL - Occupational Exposure Levels;



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OSHA - Occupational Safety and Health Administration, US department of Labour; PBT - Persistent, Bioaccumulative and Toxic; PEL - Permissible exposure limit; PNOR - Particulate Not Otherwise Regulated; RID - European Agreement concerning the International Carriage of Dangerous Goods by Rail; REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals; RPE - Respiratory Protection Equipment; SARA (Title III) - Superfund Amendments and Reauthorization Act; SARA 313 - Superfund Amendments and Reauthorization Act, Section 313; SDS - Safety Data Sheet; STOT - Specific Target Organ Toxicity; SVHC - Substances of Very High Concern; TLV - Threshold Limit Value; TSCA - Toxic Substances Control Act Public Law 94-469; TWA - Time-Weighted Average; US DOT - US Department of Transportation; vPvB - Very Persistent, Very Bioaccumulative; WHMIS - Workplace Hazardous Materials Information System.

16.6 Revisions:

April 2009 - Data Sheet updated to reflect the latest supplier safety information.

June 2010 - Data Sheet updated to reflect current regulatory information.

July 2015 - Data Sheet updated to conform to Regulation (EC) No 1907/2006 (as amended by Regulation 453/2010) and GHS.

January 2016 - Contact details updated. Revision date not changed to preserve 2-yearly SDS review date.

July 2016 - Data sheet updated to reflect latest supplier and regulatory information.

Although the information and recommendations in this data sheet are to the best of our knowledge correct, it is recommended that you make your own determination of the material's suitability for your purpose before you use it. It should not, therefore, be construed as guaranteeing any specific property of the product.