**6 February 2014**

# Background document for Zirconia Aluminosilicate Refractory Ceramic Fibres (Zr-RCF)

**Document developed in the context of ECHA's fifth Recommendation for the inclusion of substances in Annex XIV**

*Information comprising confidential comments submitted during public consultation or relating to content of Registration dossiers, which is of such nature that it may potentially harm the commercial interest of companies if it was disclosed, is provided in a confidential annex to this document.*

## 1. Identity of the substance

Zirconia Aluminosilicate Refractory Ceramic Fibres *are fibres covered by index number 650-017-00-8 in Annex VI, part 3, table 3.1 of Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, and fulfil the three following conditions: a) oxides of aluminium, silicon and zirconium are the main components present (in the fibres) within variable concentration ranges b) fibres have a length weighted geometric mean diameter less two standard geometric errors of 6 or less micrometres (µm) c) alkaline oxide and alkali earth oxide (Na2O+K2O+CaO+MgO+BaO) content less or equal to 18% by weight.*

| | |
|---|---|
| Chemical name: | Zirconia Aluminosilicate Refractory Ceramic Fibres |
| EC Number: | - |
| CAS Number: | - |
| IUPAC Name: | - |

## 2. Background information

### 2.1. Intrinsic properties

Zirconia Aluminosilicate Refractory Ceramic Fibres (Zr-RCF) were identified as a Substance of Very High Concern (SVHC) in accordance with Article 57 (a) as they are classified in Annex VI, part 3, Table 3.1 (the list of harmonised classification and labelling of hazardous substances) of Regulation (EC) No 1272/2008 as

carcinogen, Carc. 1B[1] (H350i: "May cause cancer"), and were therefore included in the Candidate List for authorisation on 19 December 2011, following ECHA's decisions ED/77/2011 and ED/95/2012.

## 2.2. Imports, exports, manufacture and uses

### *2.2.1. Volume(s), imports/exports*

According to the current analysis of the registration dossiers received, the annual volume of Zirconia Aluminosilicate Refractory Ceramic Fibres (Zr-RCF) imported into the EU is in the range of 1,000 – 10,000 t. This tonnage has to be seen as minimum as there might be more registrations falling under the Candidate List entry.

### *2.2.2. Manufacture and uses*

#### 2.2.2.1. Manufacture and releases from manufacture

Generally, refractory ceramic fibres (RCF) are manufactured from the melting of calcined or pure minerals such as silica, alumina, zirconia, kaolin. The manufacture process consists of blowing an air stream on the molten material flowing from an orifice at the bottom of the melting furnace (blowing process) or by directing the molten material onto a series of spinning wheels (spinning process) (Annex XV report, 2009, 2011).

Occupational exposure of RCF may occur during the manufacturing process. In primary production 750 workers are exposed regularly in the EU (Annex XV report, 2009, 2011).[2] IOM (SHEcan report, 2011 referred to in RCOM 2014) estimates that currently about 730 workers are employed (and exposed) in RCF manufacturing plants in the EU.

#### 2.2.2.2. Uses and releases from uses

The substance as such ("loose wool") is used as filling material for construction-conditioned expansion joints in refractory constructions that gives space to thermal or thermal-chemical expansion but which at the same time needs to give sufficient resilience to avoid any particles getting into the joints e.g. cement dust. It is also mentioned that the bulk fibre is used in furnaces to fill in gaps and hollow spaces which is necessary for accurate and stable process temperatures (RCOM, 2014).

The bulk material can be converted into several types of products. Using processes similar to those in the paper industry, the bulk material can be processed into boards, shapes, felts and papers. Such uses include, according to registration data, process types such as low energy manipulation (PROC 21) as

[1] This corresponds to a classification as carcinogen cat. 2 (R45: "May cause cancer") in Annex VI, part 3, Table 3.2 (the list of harmonised classification and labelling of hazardous substances from Annex I to Directive 67/548/EEC) of Regulation (EC) N° 1272/2008

[2] According to ECFIA (RCOM, 2014) this number is based on data gathered in 1995.

well as open processing and transfer operations at elevated temperatures/high energy work-up (PROCs 23 and 24) (ECHA, 2013). Typical shapes are sheets, bricks, blankets, rolls, modules, ropes and strings. Blankets are often used directly, (e.g. as a furnace insulation material), but they are also converted into modules used for furnace lining, gaskets and other products or articles[3]. The bulk material can also be used for textiles and mixed into cements and putties (Annex XV report, 2009, 2011; RCOM, 2014). Where the substance is used for formulation of mixtures or in materials, beside others, processes like mixing or blending in multistage and/or with significant contact (PROC 5), transfer at non-dedicated facilities (PROC 8a) or high (mechanical) energy work-up (PROC 24) take place (ECHA, 2013).

Zr-RCF are used in high temperature industries as insulation. The largest single use is furnace linings and related applications (67%) (Annex XV report, 2009, 2011).

Information provided during the public consultation (RCOM, 2014) specified the uses further: RCF are low mass insulation material and typically used for thermal insulation, heat shields, heat containment, gaskets and expansion joints at temperatures up to 1400°C (temperatures can reach ranges of 1600°C to 1850°C) in industrial furnaces, ovens kilns, boilers, heating systems and other process equipment (e.g. ladles, tundishes, furnace doors). Furthermore, they are also used for electrical insulation, acoustic absorption, ceramic and metal composite reinforcement and fire burn through protection, e.g. in aerospace industry.

Processes in which RCF are used for insulation vary widely, e.g.

- metal production (steel and non-ferrous) and metal processing (such as forging and foundries) including metal transfer and casting operations (launders, moulds, cone fibres, casting tips), pre-heating furnaces for rolling and extrusion operations and in the refining process inside decoaters and swarf dryers
- gas production for industry, health and the environment (e.g. in steam methane reforming production units for insulating roofs and at expansion joints).

Applications include uses in/for

- automotive industry supply chain (e.g. mats within catalytic converter systems and within diesel particulate filter systems, wrapping and structural enhancer/thermal stabiliser for autocatalysts substrate),
- aerospace and defence products (e.g. wheels, brakes, engine nacelles),
- high temperature coatings, foams, papers and adhesive tapes,
- parts used in the manufacture of semiconductor devices (e.g. diffusion furnaces, annealing systems, exhaust abatement systems, thyristors, diodes) and photovoltaic cells,
- manufacture of ceramic tiles (e.g. cladding tiles, stoneware and porcelain stoneware),

[3] While the use of articles does not fall under the authorisation requirement, the incorporation of substances included in Annex XIV into articles does require authorisation. When applying for authorisation for the uses that require authorisation, the whole life-cycle of the substance needs to be considered. Therefore, e.g. the CSR needs to cover exposure during the service-life of articles and, where relevant, the waste stage. That means - as also mentioned in the prioritisation approach - all sites where the substance is used as such, in mixtures and/or in form of an article produced in the EU are relevant in the assessment of the wide dispersiveness.

- press furnaces for fabrication of metal-ceramic and all-ceramic dental restorations,
- glass, special glass and glass ceramic production (e.g. insulation, sealing, expansion joints).

Occupational exposure of Zr-RCF may occur during mixing and forming processes, cutting or machining the material after fibre manufacture (finishing processes) and during processes where the fibres are combined or assembled with other material. Fibre dust is present during all installation and end use processes (described e.g. by PROC 21 in registrations). This includes e.g. building or manufacturing industrial furnaces or boilers for refinery or petrochemical plant equipment, kilns, foundry equipment, electric power generators at end-user locations. Exposure also occurs during furnace inspection, maintenance, repair and removal of RCF from industrial furnace. It was stated by industry that usage possibilities for moulded parts are limited however these are applied everywhere where bulk fibre can be avoided (Annex XV report, 2009, 2011; RCOM, 2014). High temperatures systems involving RCFs are described as closed (PROCs 1, 2) or potentially closed (PROC 22).

The European Chemical Fibre Industry Association (ECFIA) estimated around 25,000 employees to be dealing with RFC including manufacturing. Regularly exposure occurs at convertors (850 workers). Sporadically exposure occurs to workers in the field of installation contractors (1,500 workers) and end uses (21,000 workers) (Annex XV report, 2009, 2011).[4] ECFIA (RCOM, 2014) currently estimates that about 1,300 workers are potentially exposed at converters, primary production and installation. ECFIA further estimates based on a study by IOM (SHEcan report, 2011 cited in RCOM 2014) about 8,600 workers working in the field of end use. IOM is cited to estimate the total number of regularly exposed workers in the EU at about 10,000.

#### 2.2.2.3. Geographical distribution and conclusions in terms of (organisation and communication in) supply chain

Based on the available information, it appears that although Zr-RCF is imported by a limited number of sites (< 10), the substance is used at a high number of sites.

Comments received during the public consultation (RCOM, 2014) indicate the use of Zr-RCF by a high number of companies. Processes where the substance is used vary widely and applications are very diverse. The registrations cover industrial as well as professional uses of the substance.

Therefore, although the exact number of sites using the substance is not known, based on available information on the types of uses a high number of sites is anticipated. The use of Zr-RCF is considered to be widespread.

[4] According to ECFIA (RCOM, 2014) these numbers are based on data gathered in 1995. They were published in 1999.

## 2.3. Availability of information on alternatives[5]

Substitutes with a lower health risk include both fibrous and fibre-free refractory products. Fibrous products for application in the temperature range to 300 °C generally comprise glass and mineral wools. For the temperature range from 300 °C to approx. 600 °C, mineral wools or alkaline earth silicate (AES) wools can be used depending on the specific requirements of the application. From 600 °C to approx. 900 °C, generally AES wool products can be used (Annex XV report, 2009, 2011).

Above 900 °C to max. 1200 °C, the possibility for using AES wool products may be reduced owing to technological constraints, e.g. rapid degradation of the material >900°C and its brittleness requiring more frequent maintenance (including e.g. full relining of furnaces instead of repairing certain areas only) due to much lower durability. This temperature range is the main application range for aluminium silicate wool products. On the other hand current product developments indicate that the upper temperature limit of AES wool products could be increased significantly (Annex XV report, 2009, 2011).

RCFs could also be replaced by polycristalline wools (PCW). However, according to industry (RCOM, 2014), this is a high cost material (at least 10 times the cost of AES or RCF) which therefore would cause the EU-business being uncompetitive compared to non-EU-competitors. In addition, although currently not harmonised classified, the substance could be in future due to their fibrous form. Industry also refers to TRGS 619 where it is stated that "PCW cannot be recommended as substitutes".

Non-fibrous substitutes are refractory materials such as calcium silicate or vermiculite panels and mouldings, thermal insulation bricks and concretes, lightweight refractory bricks and concretes, thermal insulation refractory compounds and other non-fibrous products that meet the application requirements as substitute products (Annex XV report, 2011). Industry (RCOM, 2014) states that bricks and concretes have some limitations in use, in particular due to their extra weight and due to less flexibility leading to reduced energy efficiency.

Industry acknowledges the availability of alternatives for some applications. Alternatives to RCFs are e.g. brick linings or castable linings; fibre-free foamed clay aggregate; high-temperature microporous insulation material based on alumina as well as on aluminia/mullite; high porous ultra-light non-fibrous ceramic foams based on alumina and mullite; ultra-high temperature microporous insulation material. However, it has been stated that there is no validated substitute available for some industries where fibres are exposed at high temperature applications (900 – 1200 °C, and above) for long durations (e.g. Steam Methane Reforming) and/or are used in chemically aggressive atmospheres (RCOM 2009, 2011; RCOM, 2014).

[5] Please note that this information was not used for prioritisation.

## 2.4. Existing specific Community legislation relevant for possible exemption

There seems to be no specific Community legislation in force that would allow consideration of exemption(s) of (categories of) uses from the authorisation requirement on the basis of Article 58(2) of the REACH Regulation.

## 2.5. Any other relevant information (e.g. for priority setting)

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# 3. Conclusions and justification

## 3.1. Prioritisation

The substance is used in high volumes in the scope of authorisation. The use of the substance is expected to take place at a high number of sites, and can potentially lead to significant worker exposure.

*Verbal-argumentative approach*

On the basis of the criteria, Zirconia Aluminosilicate Refractory Ceramic Fibres have a high priority for inclusion in Annex XIV.

*Scoring approach*

| Score | | | Total Score |
|---|---|---|---|
| Inherent properties (IP) | Volume (V) | Uses - wide dispersiveness (WDU) | (= IP + V + WDU) |
| 1<br><br>Art. 57 (a); Carcinogen 1B | 7<br><br>High volume in the scope of authorisation. | Overall score: 3 * 3 = 9<br><br>Expected to be used at high number of sites in the EU. Score: 3<br><br>Potential for significant exposure to workers. Score: 3 | 17 |

*Conclusion, taking regulatory effectiveness considerations into account*

On the basis of the prioritisation criteria, Zirconia Aluminosilicate Refractory Ceramic Fibres get high priority for inclusion in Annex XIV.

Therefore, it is proposed to prioritise Zirconia Aluminosilicate Refractory Ceramic Fibres for inclusion in Annex XIV.

# 4. References

Annex XV report (2009) - Zirconia Aluminosilicate, Refractory Ceramic Fibres. Proposal for identification of a substance as a CMR Cat 1 or 2, PBT, vPvB or a substance of an equivalent level of concern. Submitted by Germany, August 2009. http://echa.europa.eu/documents/10162/47c8a92c-8fb4-4b0f-85b8-64037ad542ad

Annex XV report (2011) - Zirconia Aluminosilicate, Refractory Ceramic Fibres. Proposal for identification of a substance as a CMR Cat 1A or 1B, PBT, vPvB or a substance of an equivalent level of concern. Submitted by Germany, August 2011. http://echa.europa.eu/documents/10162/1fe242c7-c234-447d-89f1-5e71f87ca1ec

ECHA (2013): Dissemination information on List number 604-314-4: http://apps.echa.europa.eu/registered/data/dossiers/DISS-9fdb75a2-3534-1a7f-e044-00144f67d031/DISS-9fdb75a2-3534-1a7f-e044-00144f67d031_DISS-9fdb75a2-3534-1a7f-e044-00144f67d031.html

RCOM (2009) – "Responses to comments" documents. Document compiled by the German CA from the commenting period 29/08/2011 – 13/10/2011 on the proposal to identify the substance Zirconia Aluminosilicate, Refractory Ceramic Fibres as Substance of Very High Concern. http://echa.europa.eu/documents/10162/6abbd4a9-b99c-4b2e-b2ec-39b6b7e105ec

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RCOM (2014): "Responses to comments" document for Zr-RCF. Document compiling comments and respective answers from commenting period 24/06/2013 –23/09/2013 on ECHA's 5th draft recommendation of priority substances for inclusion in the list of substances subject to authorisation (Annex XIV). http://echa.europa.eu/documents/10162/13640/axiv_5th_recommendation_zr-rcf_rcom_en.pdf