Section 1: PRODUCT AND COMPANY IDENTIFICATION

A Product Name  Zirconium Oxide

Synonyms  All anhydrous Zirconium Dioxide products, All grades of zirconium oxide, including spectrographic grade, jet milled, reactor grade (Product #304)

Product Code  SAC018

B Recommended Use  Chemical intermediate

C Supplier

Manufacturer  ATI, 1000 Six PPG Place, Pittsburgh, PA 15222 USA

Emergency Telephone  Chemtrec +1 703-741-5970

Section 2: HAZARDS IDENTIFICATION

A GHS - Classification

Not a hazardous substance or mixture according to the Globally Harmonized System (GHS)

B Label elements

Emergency Overview

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Physical state</th>
<th>Odor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powder</td>
<td>Solid</td>
<td>Odorless</td>
</tr>
</tbody>
</table>

C Other Information

Hazards not otherwise classified (HNOC)

• Not applicable

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms  All anhydrous Zirconium Dioxide products, All grades of zirconium oxide, including spectrographic grade, jet milled, reactor grade (Product #304).

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>Weight-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium Dioxide</td>
<td>1314-23-4</td>
<td>&gt;99</td>
</tr>
</tbody>
</table>

Section 4: FIRST AID MEASURES

A Eye contact  In the case of particles coming in contact with eyes during processing, treat as with any foreign object

B Skin Contact  None under normal use conditions

C Inhalation  If excessive amounts of smoke, fume, or particulate are inhaled during processing, remove
to fresh air and consult a qualified health professional

D Ingestion
  IF SWALLOWED Call a POISON CENTER or doctor/physician if you feel unwell

E Symptoms
  None anticipated.

F. Indication of immediate medical attention and special treatment needed, if necessary
  Treat symptomatically.

Section 5: FIRE FIGHTING MEASURES

A Suitable extinguishing media
  Non-combustible

Unsuitable extinguishing media
  Non-combustible

B Specific hazards arising from the chemical
  Non-combustible

  Hazardous combustion products
  Not applicable.

C Special protective equipment for fire-fighters
  Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear.

Section 6: ACCIDENTAL RELEASE MEASURES

A Personal precautions
  Use personal protective equipment as required.

  For emergency responders
  Use personal protective equipment as required.

B Environmental precautions
  Collect spillage to prevent release to the environment

C. Methods and material for containment and cleaning up

  Methods for containment
  Prevent further leakage or spillage if safe to do so

  Methods for cleaning up
  Sweep or shovel material into dry containers Avoid creating uncontrolled dust

Section 7: HANDLING AND STORAGE

A Advice on safe handling
  Handle in accordance with good industrial hygiene and safety practice

B Storage Conditions
  Keep in properly labeled containers

  Incompatible materials
  None known

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

A Control parameters
  This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium Dioxide</td>
<td>STEL: 10 mg/m³</td>
</tr>
<tr>
<td></td>
<td>TWA: 5 mg/m³</td>
</tr>
</tbody>
</table>

B Engineering Controls
  Avoid generation of uncontrolled particles

C Personal Protective Equipment
  Respiratory protection
  When particulates/fumes/gases are generated and if exposure limits are exceeded or irritation is experienced, proper approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
Eye/face protection
When airborne particles may be present, appropriate eye protection is recommended. For example, tight-fitting goggles, foam-lined safety glasses or other protective equipment that shield the eyes from particles.

Skin and body protection
Wear protective gloves

General Hygiene Considerations
Handle in accordance with good industrial hygiene and safety practice.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES
Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks • Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Physical state</td>
<td>Solid</td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>Powder</td>
<td>Color</td>
</tr>
<tr>
<td>B Odor</td>
<td>Odorless</td>
<td></td>
</tr>
<tr>
<td>C Odor threshold</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>D pH</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>E Melting point/freezing point</td>
<td>2710 °C / 4910 °F</td>
<td></td>
</tr>
<tr>
<td>F Boiling point / boiling range</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>G Flash point</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>H Evaporation rate</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>I Flammability (solid, gas)</td>
<td>-</td>
<td>Not flammable</td>
</tr>
<tr>
<td>J Flammability Limit in Air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper flammability limit:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower flammability limit:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K Vapor pressure</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>L Solubility(ies)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water solubility</td>
<td>Insoluble</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M Vapor density</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>N Specific Gravity</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>O Partition coefficient</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>P Autoignition temperature</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Q Decomposition temperature</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>R Kinematic viscosity</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Dynamic viscosity</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>S Molecular weight</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Other Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosive properties</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Oxidizing properties</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Softening point</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>VOC Content (%)</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Bulk density</td>
<td>110-130 lb/ft3</td>
<td></td>
</tr>
</tbody>
</table>

Section 10: STABILITY AND REACTIVITY

A Stability
Stable under normal conditions

Explosion data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

B Possibility of Hazardous Reactions
Hazardous polymerization
None under normal processing
Hazardous polymerization does not occur

C Conditions to avoid
Dust formation and dust accumulation

D Incompatible materials
None known

E Hazardous Decomposition Products
None known
Section 11: TOXICOLOGICAL INFORMATION

A  Information on likely routes of exposure

- **Inhalation**: Product not classified.
- **Ingestion**: Product not classified.
- **Eye contact**: Product not classified.
- **Skin Contact**: Product not classified.

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

- **Skin corrosion/irritation**: Product not classified.
- **Serious eye damage/eye irritation**: Product not classified.
- **Sensitization**: Product not classified.
- **Carcinogenicity**: Product not classified.
- **Germ cell mutagenicity**: Product not classified.
- **Reproductive toxicity**: Product not classified.
- **STOT - single exposure**: Product not classified.
- **STOT - repeated exposure**: Product not classified.

C  Numerical measures of toxicity

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium Dioxide</td>
<td>&gt;5000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3 mg/L</td>
</tr>
</tbody>
</table>

Information on toxicological effects

- **Symptoms**: None known.

Section 12: ECOLOGICAL INFORMATION

A  Ecotoxicity

This product as shipped is not classified for aquatic toxicity.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Algae/aquatic plants</th>
<th>Fish</th>
<th>Toxicity to microorganisms</th>
<th>Crustacea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium Dioxide</td>
<td>The 15 d NOEC of zirconium dichloride oxide to Chlorella vulgaris was greater than 200 mg/L</td>
<td>The 96 h LL50 of zirconium dioxide to Danio rerio was greater than 100 mg/L</td>
<td>The 48 h EC50 of zirconium dioxide to Daphnia magna was greater than 100 mg/L</td>
<td></td>
</tr>
</tbody>
</table>

B  Persistence and degradability

C  Bioaccumulation

D  Mobility

E  Other adverse effects

Section 13: DISPOSAL CONSIDERATIONS

A  Waste from residues/unused products

Disposal should be in accordance with applicable regional, national and local laws and regulations.

B  Contaminated packaging

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Section 14: TRANSPORT INFORMATION
Section 15: REGULATORY INFORMATION

A Industrial Safety and Health Law

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ISHA - Harmful Substances Prohibited for Manufacturing, Importing, Transferring, or Supplying</th>
<th>Korea. Harmful Substances Requiring Permission</th>
<th>ISHA - Substances to be controlled - Organic Substances</th>
<th>ISHA - Substances to be controlled - Metals</th>
<th>ISHA - Substances to be controlled - Acids and bases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium Dioxide</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

B Toxic Chemicals Control Law

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Toxic Chemical Classification Listing (TCCL) - Toxic Chemicals</th>
<th>Toxic Chemicals Control Law - Banned and/or restricted</th>
<th>Toxic Chemicals Control Law - Restrictions on use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium Dioxide</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

C Hazard Class

Not regulated

D Packing Group

Not regulated

E Marine pollutant

Not regulated

Section 16: OTHER INFORMATION

A Prepared By

B Issue Date

28-May-2015

C Revision Date

17-Mar-2017

Version

4

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances
D  Other Information

Note:
The information provided in this safety data sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

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Safety data sheets and labels available at ATImetals.com