



GPS/JIPS Safety Summary

1. SUBSTANCE NAME

Silicon carbide (CAS No. 409-21-2)

2. GENERAL STATEMENT

Compared to Si (silicon)-based power semiconductors, which are currently mainstream, SiC (Silicon carbide)-based power semiconductors are superior in high temperature resistance, high voltage resistance, and large current characteristics. As a result, demand is rapidly increasing for a wide range of applications such as electric vehicles, railways, and industrial equipment, as it contributes to energy saving, high efficiency, and miniaturization of power modules. Appropriate protective equipment should be worn during use to protect eyes, skin and avoid inhalation.

3. CHEMICAL IDENTITY

| Item | Description |
|--------------------------|--|
| Chemical or generic name | Silicon carbide |
| Trade name | 4H-SiC epitaxial wafer |
| Other No. | Japan: Chemical Substances Control Law (1)-174 Japan: Industrial Safety and Health Act, existing chemical substance |
| Chemical Formula | SiC |
| Source/References | Section 3 of the SDS issued by Resonac Corporation |

4. USES AND APPLICATIONS

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|-----------|--|
| Main uses | DC/AC converter for solar power generation, High efficiency inverter for EV, Power inverters for railways and industrial equipment, etc. |
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5. PHYSICAL/CHEMICAL PROPERTIES

The product is light green crystals. In normal conditions, this product is an extremely stable substance and is stable against heating, water, air/oxygen, and many chemicals such as acids, but it reacts when mixed with strong oxidizing agents. So, it should be stored away from contact with strong oxidizing agents.

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|-----------------------------|---|
| Appearance | Solid |
| Colour | Lite green |
| Odour | odourless |
| Melting point/Boiling point | No data applicable/ No data applicable |
| Decomposition temperature | 2700°C |
| Density | 3.2 g/cm ³ |
| Sources/references | Section 9 and 10 of the SDS issued by Resonac Corporation |

6. HEALTH EFFECTS

| Effect assessment | Results (GHS Hazard Classification) |
|-----------------------|-------------------------------------|
| Acute toxicity (oral) | Classification not possible |

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|--|---|
| Acute toxicity (dermal) | Classification not possible |
| Acute toxicity (inhalation: gas) | Not applicable |
| Acute toxicity (inhalation: vapours) | Classification not possible |
| Acute toxicity (inhalation: dust, mist) | Classification not possible |
| Skin corrosion/irritation | Classification not possible |
| Serious eye damage/eye irritation, | Classification not possible |
| Respiratory sensitisation | Classification not possible |
| Skin sensitisation | Classification not possible |
| Germ cell mutagenicity | Classification not possible |
| Carcinogenicity | Classification not possible |
| Reproductive toxicity | Classification not possible |
| Specific target organ toxicity – Single exposure, | Classification not possible |
| Specific target organ toxicity (repeated exposure) | Classification not possible |
| Aspiration hazard | Classification not possible |
| Sources/references | Section 2 and 11 of SDS issued by Resonac Corporation |
| <ul style="list-style-type: none"> · GHS (Globally Harmonized System of Classification and Labelling of Chemicals): A system that classifies chemicals according to the type and degree of hazards, labels the information, and provides safety data sheets according to globally harmonized rules. · Not applicable: Since the priority of physical state, chemical structure, chemical property, and hazard items used in the GHS classification procedures does not fall under the category, it is not subject to the classification for the category. · Not classified: Sufficient information has been obtained to implement the GHS classification, and as a result of the classification, it does not fall under any of the hazard categories specified in the GHS. It is considered to be a lower hazard. · Classification not possible: There is not enough information for GHS classification, and classification is not possible. | |

7. ENVIRONMENTAL EFFECTS

| Effect assessment | Results (GHS Hazard Classification) |
|---|---|
| Hazardous to the aquatic environment, short-term (acute) | Classification not possible |
| Hazardous to the aquatic environment, long-term (chronic) | Classification not possible |
| Hazardous to the ozone layer | Classification not possible |
| Sources/references | Section 2 and 11 of SDS issued by Resonac Corporation |

| Environmental fate/dynamics | |
|-----------------------------|--|
| Mobility in soil | No data available |
| Persistence/degradability | No data available |
| Bioaccumulation potential | No data available |
| Conclusion about PBT/vPvB | The criteria for persistent bioaccumulative and toxic (PBT; remaining persistently in the environment and possessing high bioaccumulation potential and toxicity) and very persistent and very bioaccumulative (vPvB; remaining very persistently in the environment and possessing very high bioaccumulation potential) chemicals are believed to inapplicable. |
| Sources/references | Sections 12 of the SDS issued by Resonac Corporation |

8. EXPOSURE

| Details | Exposure potentials through main uses |
|-------------------------|--|
| Occupational exposures | <p>During batch and other process operations, there is a potential for dermal and inhalation exposure to operators during maintenance, sampling, filling, emptying, and equipment failure (PROC 4).</p> <p>There is a potential for dermal or inhalation exposure in operators due to dust generation, etc. in the manufacturing operation of formulation products or articles by tableting, compressing, squeezing, and pelletizing this product (PROC 14).</p> |
| Consumer exposures | This product is not used directly by general consumers. |
| Environmental exposures | Although emission to the environment is limited because the product is typically manufactured and used in a closed process, the product can be released primarily into the atmospheric and water environment during the manufacturing process (ERC 1). |
| Precautions | If there is a possibility of exposure in other uses, take appropriate measures with reference to recommended risk management measures. |

9. RISK MANAGEMENT RECOMMENDATIONS

Recommended risk management measures can minimize risks to workers, consumers, and the environment from Section 8 exposure scenarios.

| Details | Risk management recommendations |
|---------|--|
| Worker | <p>Technical measures</p> <p>To protect workers from dust, this product has been handled in a place with forced general ventilation using a local exhaust system and wear appropriate protective equipment. Install facilities for eye and body washing near the handling place.</p> |
| | <p>Local exhaust and general ventilation</p> <p>In order to protect from dust generated by processing this product, handle this product in an area where forced general ventilation is possible and use local exhaust ventilation. Since there is a possibility of exposure during transfer work to a container, etc., should be handled in a place with and forced general ventilation and use local exhaust ventilation. When to transfer of this product to containers in dedicated equipment, should be handled in a place with and forced general ventilation and use local exhaust ventilation. For molding work that does not generate dust, handle in a well-ventilated room with a local exhaust system.</p> |
| | <p>Permissible concentration</p> <p>The American Conference of Governmental Industrial Hygienists (ACGIH) has published the time-weighted average (TLV-TWA) of 0.1 f/cc (F), TLV-TWA 10 mg/m³ (I,E), 3 mg/m³ (R,E). Manage and control the concentration below these values.</p> |
| | <p>Protective equipment</p> <p>For work that generates dust by processing this product, wear respiratory protection (dust mask with a collection efficiency 90% or higher) and chemical-resistant rubber gloves (APF5 [protection efficiency 80%]) to avoid contact with the skin.</p> |

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| | <p>【Examples of protective equipment】</p> <p>Respiratory protection : dust mask with a collection efficiency 90% or higher</p> <p>Skin protection : chemical-resistant rubber gloves (APF5 [protection efficiency 80%])</p> <p>Eye protection : safety eyewear/face protection</p> <p>Otherskin and body protection : appropriate safety clothing</p> <p>Precautions</p> <p>The operation manager should educate operators about the selection of appropriate protective equipment, proper usage method, and control method of the work site.</p> |
| Consumer | This product is not used directly by general consumers. |
| Environment | Install appropriate wastewater treatment facilities and exhaust gas treatment facilities. In addition, take measures to prevent leakage, and pay attention to periodic confirmation of discharge volume, daily control, and handling. |
| Special notes (emergency measures in case of leakage, etc.) | <p>Precautions to human body, protective equipment, and emergency measures</p> <p>In case of a leakage, wear appropriate protective equipment to prevent inhalation, eye and face contact, and skin contact of this product.</p> <p>Environmental precautions</p> <p>Avoid release of leaked product into the environment.</p> |
| Precautions | For normal handling, emergency response, disposal, and transportation control measures, refer to sections 4, 5, 6, 7, 8, 13, and 14 of the SDS issued by Resonac Corporation. |

10. STATE AGENCY REVIEW

| Hazard assessment | Situations of review |
|---|---|
| International Chemical Safety Cards | International Chemical Safety Card ICSC: 1061 https://www.ilo.org/dyn/icsc/showcard.display?p_lang=en&p_card_id=1061&p_version=2 |
| OECD HPV | None |
| NITE-CHRIP (NITE Chemical Risk Information Platform) | https://www.nite.go.jp/en/chem/chrip/chrip_search/srhInput |
| GHS Classification Results by the Japanese Government | https://www.nite.go.jp/chem/english/ghs/20-moe-2002e.html |

11. REGULATORY INFORMATION/GHS CLASSIFICATION AND LABELLING INFORMATION

Regulatory information only in Japan

| Applicable laws | Regulatory situations |
|--|---|
| Act on the Regulation of Manufacture and Evaluation of Chemical Substances | Excluding priority assessment chemical substances (Article 2-5 of the Act) Silicon carbide |
| Industrial Safety and Health Act | Dangerous Articles and Harmful Substances Whose Names, etc. Should Be Notified (Article 57-2 of the Act, Article 18-2 item (i) and item (ii) appended Table No. 9 of the Enforcement Order) Silicon carbide (Cabinet Order Number : 336) |

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| | Exemption of Solids from the Obligation of Labelling (Out of preparations (mixtures) containing substances for which the labelling is obligatory, those that do not take any form other than solid and are not made into a powdery state while being transported or stored are exempted from the obligation of labelling.) |
| Poisonous and Deleterious Substances Control Act | Not applicable |
| Foreign Exchange and Foreign Trade Act | Cabinet Order on Export Trade Control appended Table 1 item 7, 10, 16 |
| Act on the Assessment of Releases of Specified Chemical Substances in the Environment and the Promotion of Management Improvement and Transfer Register / PRTR) | [After revision (after April 1, 2023)] Class 1 Specified Chemical Substances (Article 2-1 of the Act, Enforcement Ordinance Article 1 Appended Table 1) Silicon carbide (Control number: 667) (100 %) |

Hazards

For all items, it does not fall under the GHS Classification criteria.

Labelling Information

Hazard pictograms (GHS): No labelling applicable

Signal word (GHS): No labelling applicable

Hazard statements (GHS): No labelling applicable

12. CONTACT INFORMATION

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|-------------|---|
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13. DATE OF ISSUE / REVISION, ADDITIONAL INFORMATION

Date of issue: December 27, 2022

Revisions:

| Date of revision | Revised section | Revised item | Version |
|------------------|-----------------|----------------------------------|---------|
| January 1, 2023 | 3, 6, 7, 10-13 | update to the latest information | Rev.2 |

The contents are based on the safety data sheet (SDS) revised on January 1, 2023.

Special instructions: none

14. DISCLAIMER

The safety summary is part of the effort for the voluntary management of chemical substance in the chemical industry (GPS/JIPS: Japan Initiative of Product Stewardship). The purpose of the safety summary is to provide information on the safe handling of the product as an overview and not to provide professional information, such as the risk evaluation process and its impact on human health and the environment. This document is not meant to serve as an alternative to risk evaluation, such as a Safety Data Sheet (SDS) or a Chemical Safety Report (CSR). This safety summary is being written as accurately as possible based on data such as laws, materials, and information available at the time of publication, but it does not include all data. It does not

guarantee anything.