Product Safety Assessment

*CVD SILICON CARBIDE™ Components*


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Names

- CAS No. 409-21-2
- SiC
- CVD SILICON CARBIDE™ Components
- Silicon carbide

Product Overview

- CVD SILICON CARBIDE™ Component is the trade name for silicon carbide parts and bulk sheet material manufactured by Rohm and Haas Company, a wholly owned subsidiary of The Dow Chemical Company. These products are high-performance solid ceramic parts sold in a variety of shapes (disks and rings). CVD SILICON CARBIDE Components have a grey-black matte finish or a silver, mirror-like finish.¹ For further details, see Product Description.
- Industrial customers typically use silicon carbide components as finished parts for semiconductor processing equipment (e.g., mechanical seals, gas discharge plates, wet-etch wafer carriers, focal rings).² For further details, see Product Uses.
- Most industrial users of CVD SILICON CARBIDE Components will only have physical contact with the solid ceramics. Occupational exposure to silicon carbide dusts is possible at the Rohm and Haas manufacturing facility as well as at customer facilities that further machine or polish the Dow material. CVD SILICON CARBIDE Components are not sold directly or indirectly to the general public. Exposure to silicon carbide dusts by the general public is not expected since these dusts and particulates are removed from industrial air and water emissions associated with the manufacturing processes.³ For further details, see Exposure Potential.
- Contact with surfaces of solid CVD SILICON CARBIDE Components or bulk sheet material is not associated with adverse health effects. Health hazards do exist for dusts generated from machining and polishing operations. Silicon carbide dusts can cause mechanical irritation to eyes, skin and respiratory system. Beyond being a nuisance particulate, silicon carbide is known to accumulate in lungs. Studies indicate that irreversible lung disease can occur and resemble effects of asbestos toxicity. Airborne silicon carbide is regarded as a suspect human carcinogen based on animal studies and studies of smelter workers, although co-exposure to crystalline silica may have also occurred. No effects are known to result from ingestion.⁴,⁵ For further details, see Health Information.

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- Silicon carbide is expected to be inert in the environment. Aquatic toxicity is unlikely due to low solubility. For further details, see Environmental Information.
- CVD SILICON CARBIDE™ Components are stable under normal storage and use conditions. Dry machining may produce an explosive dust. Avoid static discharge. For further details, see Physical Hazard Information.

Manufacture of Product

- **Locations** – Rohm and Haas Company, a wholly owned subsidiary of The Dow Chemical Company, manufactures CVD SILICON CARBIDE™ Components at facilities in Weeks Island, Louisiana and Marlborough, Massachusetts, USA. Finished components as well as blanks are available for purchase in Asia/Pacific, Europe, and North America.
- **Process** – Rohm and Haas uses a process called chemical vapor deposition (CVD) to grow silicon carbide sheets in high temperature (>2,220°F), low pressure (<5 psi) furnaces. Liquid methyltrichlorosilane is evaporated into the furnace with hydrogen and argon gas to produce silicon carbide. Once cooled, the silicon carbide ceramic sheets are removed from the furnace for cutting and polishing into various shaped disks and rings. The cutting process uses diamond-impregnated cutting tools similar to metal fabrication equipment.

Product Description

CVD SILICON CARBIDE™ Components are solid ceramic parts. These products are sold in a variety of shapes (disks and rings) as shown below:

Some components are grey-black in color and have matte finish. Other components have a highly polished mirror finish with a silver appearance. The shapes are cut from internally manufactured sheets (see image below).
CVD SILICON CARBIDE™ Components have high chemical purity (>99.999%), high density (>3 g/ml), high resistance to thermal decomposition 2,700ºC (4,890ºF), and high resistance to chemical and plasma energy corrosion.

Product Uses

CVD SILICON CARBIDE™ Components are high-performance ceramic parts used for semiconductor processing equipment, like mechanical seals, gas discharge plates, wet-etch wafer carriers, focal rings, etc.

Exposure Potential

CVD SILICON CARBIDE™ Components are solid ceramics used in the production of industrial products. Based on this, the public could be exposed through:

- **Workplace exposure** – Most users of CVD SILICON CARBIDE Components will handle only the finished ceramic. Exposure to silicon carbide dusts is possible at facilities that manufacture CVD SILICON CARBIDE Components as well as at customer facilities that further machine or polish the parts that are made using these materials. Each manufacturing facility should have a thorough training program for employees and appropriate work processes and safety equipment in place to limit exposure. See Health Information.

- **Consumer exposure to CVD SILICON CARBIDE Components** – Dow does not directly or indirectly sell these components to the general public so exposure is not likely. Silicon carbide dusts and particulates are removed from industrial air and water emissions associated with the manufacturing processes. See Health Information.

- **Environmental releases** – Breakage of CVD SILICON CARBIDE Components may present a slipping hazard due to particle fragments, or a physical hazard to sharp edges. Fragments should be swept up with precautions given to sharp metal, and then discarded as solid waste. If breakage produces dust particles, moisten the area prior to sweeping to prevent inhalation of dusts.

- **Large release** – Large releases are not possible due to the physical state of the product.

- **In case of fire** – CVD SILICON CARBIDE Components are non-combustible. Fight fire with extinguishing media appropriate to the surrounding fire. As a precaution deny any unnecessary entry into the area. Firefighters should wear positive pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Follow emergency procedures carefully. See Health, and Physical Hazard Information.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Health Information

CVD SILICON CARBIDE™ Components are solid ceramic parts and do not pose health hazards. Health hazards do exist for silicon carbide dusts generated from machining and polishing operations.

- **Eye contact** – Like any foreign body, direct contact with particles or dusts can cause mechanical irritation (scratch or abrade the eye). Slight to moderate eye irritation is possible.

- **Skin contact** – Direct contact can cause skin irritation.

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Inhalation – Inhalation of product dusts during processing can irritate the nose, throat, and lungs. Nausea, dizziness, and headache are also possible.

Ingestion – No effects are known to result from ingestion.

Repeated exposure – Silicon carbide dusts are known to accumulate in lungs and studies have indicated that irreversible lung disease can occur. Increased mortality from asthma, emphysema, and chronic bronchitis as well as lung cancer were reported among Norwegian silicon carbide workers exposed to dust which contained several components including fibrous and non-fibrous silicon carbide particles, quartz, the related mineral (cristobalite), and sulfur dioxide. Silicon carbide has been reported to cause mesotheliomas following chest cavity injection in rats.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Environmental Information

CVD SILICON CARBIDE™ Components do not pose ecological hazards and are expected to be inert in the environment. Although these materials are not biodegradable, they are likely to degrade slowly in the environment by a combination of physical and environmental forces.

Silicon carbide components are unlikely to accumulate in the food chain. Small fragments are not water soluble but may present a choking hazard to wildlife.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Physical Hazard Information

CVD SILICON CARBIDE™ Components are stable under normal storage and use conditions. These products are resistant to chemical corrosion. At temperatures exceeding 2,700 ºC (4,890ºF), silicon carbide ceramics will sublime. Dry machining these products may produce an explosive dust atmosphere. Avoid static discharge.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use and/or disposal of CVD SILICON CARBIDE™ Components. These regulations may vary by city, state, country or geographic region. Information may be found by consulting the relevant Safety Data Sheet, Technical Data Sheet, or Contact Us.
Additional Information

- Safety Data Sheet (www.dow.com/assistance/dowcig.htm)
- Contact Us (www.dow.com/assistance/thoughts.htm)
- Hazardous Substances Data Bank (HSDB), National Library of Medicine, U.S. Department of Health and Human Services, TOXNET web site (http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB), type in silicon carbide and/or CAS No. then click the “search” button


References

3 SiC Blank 1” x 0.5” x 0.5”, Polished Material Safety Data Sheet, Rohm and Haas Company, April 2, 2008, page 3.
4 SiC Blank 1” x 0.5” x 0.5”, Polished Material Safety Data Sheet, Rohm and Haas Company, April 2, 2008, pages 1–2.
6 SiC Blank 1” x 0.5” x 0.5”, Polished Material Safety Data Sheet, Rohm and Haas Company, April 2, 2008, page 4.
8 SiC Blank 1” x 0.5” x 0.5”, Polished Material Safety Data Sheet, Rohm and Haas Company, April 2, 2008, pages 1 and 4.
11 SiC Blank 1” x 0.5” x 0.5”, Polished Material Safety Data Sheet, Rohm and Haas Company, April 2, 2008, page 2–3.
12 SiC Blank 1” x 0.5” x 0.5”, Polished Material Safety Data Sheet, Rohm and Haas Company, April 2, 2008, pages 1–2.
14 cite Patty’s Toxicology, 5th Ed Vol 1 p 446 (2001)).

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