

1. Name of Substance or Mixture and Name of Company

- 1.1 Product identifier:
Name of substance: Gallium arsenide compact (ingot, wafer, fragments)
Chemical formula: GaAs
REACH registration No.: **01-2119561669-23-xxxx**
Molecular weight: 144.64 g/mol
- 1.2 Identified application: III - V compound semiconductor – substrates for the semiconductor industry (high frequency applications, optoelectronics).

not recommended applications: None
- 1.3 Information about supplier providing this product information:
Name of company: Freiberger Compound Materials GmbH (FCM)
Street: Am Junger-Löwe-Schacht 5
National symbol/zip code/city: D - 09599 Freiberg
Phone: +49 3731 280 - 0
Fax: +49 3731 280 - 106
E-mail: info@fcm-germany.com

Information provided by: Dept. occupational health & safety and quality management
- 1.4 Emergency number: +49 3731 280 – 0 (working days from 8:00 a. m. to 4:00 p. m.)
- Germany – FCM

2. Potential Hazards

- 2.1 Classification of substance or mixture:
Hazards caused by ingots (diameter: 3“– 8“) / wafers (diameter: 3“– 8“) / fragments of GaAs:

GaAs (ingot, wafer, fragments) is a product in terms of title I article 3 No. 3 of the REACH Regulation (EC) Nr. 1907/2006. GaAs (ingot and wafer) consists 100 % of the substance GaAs.

In the official journal of the EU regulation no. 944/2013 of 2 October 2013, GaAs was officially classified as carcinogenic substance Carc. 1B (proven in animals) and STOT RE 1 (specific target organ toxicity (repeated exposure) – lungs).

In the official journal of the EU regulation no. 2015/1221 of 24 July 2015, GaAs was officially classified as reprotoxic substance Repr. 1B (proven in animals).
- 2.2 Classification elements: Not applicable
Danger warnings / safety instructions: Not applicable
- 2.3 Other hazards:
Compact GaAs is chemically and thermally decomposable. As a result, arsenic trioxide or arsenic hydride may be released. Thermal decomposition of GaAs in absence of air may also release **arsenic**.
Thermal and chemical decomposition are not consistent with the intended use of GaAs.

3. Composition / Information on Ingredients

3.1	Substances:	
	Chemical characterization:	Gallium arsenide (GaAs)
	CAS No.:	1303 - 00 - 0
	EG No.:	215 – 114 - 8
	Purity:	99.999 %
	Stabilizers:	None
	Dangerous contaminants:	None

4. First Aid Measures

4.1	First aid measures to be taken:	
	After skin contact:	Usual work hygiene, e.g. wash with water and soap
	After eye contact:	Not applicable
	After ingestion:	Not applicable
	After inhalation:	Not applicable
4.2	Main acute and deferred symptoms and effects:	No information available
4.3	Immediate medical attention or special treatment:	Not required

5. Fire Fighting Measures

General: Gallium arsenide is not combustible. It decomposes at high temperatures.

5.1	Extinguishing agents:	Specific extinguishing agents not required Match firefighting measures with environment
	For safety reasons unsuitable extinguishing agents:	None
5.2	Specific hazards caused by substance or mixture:	Combustion gases and decomposition products containing arsenic oxide may emerge
5.3	Advice:	Use respiratory protection irrespective of environment

6. Accidental Release Measures

6.1	Individual precaution, protective equipment and emergency measures:	Compact GaAs is not hazardous. Handling of dusts and chemical compounds occurring during mechanical working is subject to local provisions (e.g. industrial safety provisions).
6.2	Environment protection:	Compact GaAs is not hazardous to the environment. Handling of dusts and chemical compounds occurring during mechanical working is subject to local provisions.
6.3	Methods and material for retention and cleaning:	Mechanical uptake
6.4	Reference to other sections:	See section 8

7. Handling and Storage

- 7.1 Protective measures for safe handling:
Observe common hygiene measures (compare sections 8.1, 8.2 and 10.1 - 10.4)
- 7.2 Conditions for safe storage considering intolerances:
Keep substance dry in closed containers, packaging material: PE foil, PE/PP containers, break-proof outer packaging
- 7.3 Specific end use: No additional information

8. Exposure Limits and Control of Exposure/ Personal Protection Equipment

- 8.1. Parameters subject to control:
In case of contact with dusts / aerosols occurring during processing

Permissible limits in air at working place

Applicable limits (country)	Controlled substance	EG-No.	CAS-No.	Permissible limit at working place [mg/m ³]		Recommended control methods	Maximum limit	Source/ Remark
				Long term	Short term			
DNEL	Gallium arsenide	215-114-8	1303-00-0	0.02 mg/m ³				Pursuant to REACH GaAs registration dossier
AGW (DE)	Arsenic tri-hydride	232-066-3	7784-42-1	0.02 ml/m ³		OSHA ID 105 NIOSH 6001 HSE 34		
ACGIH TLV	Arsenic*	231-148-6	7440-38-2	0.01		BIA method 6195 NIOSH 7300 IFA 7808		
OSHA PEL TWA (USA)	Arsenic*	231-148-6	7440-38-2	0.01				
Germany (AGS)	Arsenic compounds*	231-148-6	1327-53-3	0.0083** 0.00083***				Not applicable for GaAs, see TRGS 561 "Metalle"
Austria	Arsenic*	231-148-6	7440-38-2	0.1	0.4			Respirable as aerosol
Belgium	Arsenic*	231-148-6	7440-38-2	0.1				
Canada – Quebec	Arsenic*	231-148-6	7440-38-2	0.1				
Denmark	Arsenic*	231-148-6	7440-38-2	0.01	0.02			
Hungary	Arsenic*	231-148-6	7440-38-2		0.01			
Poland	Arsenic*	231-148-6	7440-38-2	0.01				
Spain	Arsenic*	231-148-6	7440-38-2	0.01				
Sweden	Arsenic*	231-148-6	7440-38-2	0.01				

* Calculated as As in total respirable amount of dust

** Tolerance risk TRGS 910 (11/2015)

*** Acceptance risk TRGS 910 (11/2015)

Permissible biological limit

Applicable limits (country)	Substance	EG-No.	CAS-No.	Controlled parameter	Limit	Analysed material	Source/ Remark
EKA*** (DE)	Gallium arsenide	215- 114-8	1303-00-0	Arsenic*	50 µg/l	Urine	BGI 504 – 16

*** Exposition equivalents for cancer-causing substances

For preventive medical examinations, method G16 (arsenic) according to the Procedure of the Employers' Liability Insurance Association of the German Chemical Industry (BGI 504 – 16) (German Law) is suggested.

8.2 Exposition limits and control of exposure

In case of dusts / aerosols occurring during processing at working place:

Technical measures:

- To facilitate working processes when- and wherever possible in closed equipment, to provide exhausts where and if needed
- To apply preferably wet mechanical working processes, to provide exhausts
- To use exhausts / covers / wet technologies in manual working steps

Organisational measures

- To make a risk assessment
- To prepare working instructions
- To train staff
- In case of possible contamination by dust follow the working restrictions for adolescent and pregnant persons according to legal regulations

General rules of conduct

- To avoid skin contact
- Do not eat, drink and smoke during work
- Do not keep food in working spaces
- To wear appropriate clothing
- To change soiled clothing
- To wash hands after work

Personal protection equipment

In case of compact GaAs:

To protect the product, protective gloves are recommended:
- 100 % nitrile polymer (01 mm thick) – clean room fit
- natural latex (0.5 mm thick)

Other personal protection equipment is not required.

In case of contact with dusts occurring in processing:

Respiratory protection:

Depending on working place full or half face-piece respirator

- Dusts: Particle filter P3 (recognition colour white)
- Vapours/gases: Gas filter type B (recognition colour grey)

Hand protection:

Protective gloves, if needed with cut protection

- Tested glove material: - 100 % nitrile polymer (01 mm thick) – clean room fit
- natural latex (0.5 mm thick).

Penetration time of glove material: Depending on mechanical and additional chemical exposure

Protective gloves should be replaced at first signs of wear.

Eye protection:

Depending on working place (protective glasses, full face-piece mask only in case of dusts, vapours)

Body protection:

Depending on working place (coat, suit, overall)

Environmental exposure limit and control of environmental exposureTechnical measures to avoid environmental exposure:

In case of compact GaAs:

➔ no specific measures required

In case of mechanical working processes with formation of dusts:

➔ as stipulated by local provisions, e.g.:

Exhaust air:

Systematic collection of GaAs containing exhaust air – cleaning in a multi-stage particle filter EU 7 (H7) and EU 14 (H14).

Waste water:

Systematic collection of GaAs containing waste water – purification in waste water treatment plant (collection, flocculation, neutralization, sedimentation, solids-liquid separation) – discharge of cleaned water into drain system, dumping of sludge resulting from sedimentation.

9. Physical and Chemical Properties

9.1 Basic physical and chemical properties:

Appearance:	Form:	Solid substance (ingots, wafers, fragments)
	Colour:	Grey with metallic sheen
	Odour:	None

pH:	Not applicable
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Physical and safety data:

Melting point / melting area:	1239.85°C at 1013 hPa
Thermal decomposition:	Traces from 300°C
Flash point / flammability:	Not flammable
Explosion risk /limits:	Not explosive
Fire promoting properties:	None
Vapour pressure:	Not applicable
Density:	5.33 g/cm ³ at 20°C
Solubility:	Of low solubility in water: 25.2 µg/l Not soluble in common organic solvents

9.2 Other data:	None
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10. Reactivity and Stability

10.1 Reactivity:	If stored in original packaging, incompatibility with packaging material not to be expected
10.2 Chemical stability:	Stable under normal conditions and normal use
10.3 Potential hazardous reactions:	In case of chemical treatment, toxic arsenical compounds may be released; dissolution in acids with formation of hydrogen at the same time may release arsine.
10.4 Conditions to be avoided:	Heating above 300 °C (start of decomposition)
10.5 Substances to be avoided:	Acids, bases
10.6 Hazardous decomposition products:	Thermal decomposition releases arsenic, in contact with air As ₂ O ₃ .

11. Toxicological Information

11.1 Toxicological effects:

Risk classes (substances)

Acute toxicity	<p>For compact GaAs applies: Oral, dermal absorption and inhalation are practically excluded. Test results for compact GaAs are not available.</p> <p>When processing compact wafers there may arise dusts. To counteract the carcinogen, reprotox and specific lung toxic effects, the measures under # 8.2 must be strictly observed..</p>
Cauterization/inflammation of skin	
Severe damage/irritation of eyes	
Specific target organ toxicity by one-time exposure	
Aspiration	
Deferred and chronic toxicological effects, symptoms	
Allergization of respiratory tracts/skin	
Germ cell mutagenicity	
Carcinogenity	
Reproduction toxicity	
Specific target organ toxicity by repeated exposure	

12. Ecological Information

12.1 Ecological toxicity:	A classification is not regarded as necessary. It is assumed that compact GaAs will not reach concentrations in the environmental compartment water which have a toxic effect on aquatic organisms.
12.2 Persistency and degradability:	Gallium arsenide is not degradable (inorganic elements).
12.3 Biological accumulation (food chain):	Not to be anticipated for gallium arsenide
12.4 Mobility in soil:	No evidence; geogenic traces of Ga and As are found in the environment.
12.5 Results of PBT and vPvB evaluation:	Not identified as PBT or vPvB
12.6 Other deleterious effects:	No other information

13. Disposal Information

13.1 Waste treatment procedure:

Product /residues from product processing:

According to applicable regulations these residues have to be treated as hazardous waste which by arrangement may be returned to manufacturer. Untreated GaAs containing residues not to be disposed via waste water.

Soiled package:

Specific package for GaAs wafers see #7.2; may be re-used after cleaning, returned to wafer supplier or disposed according to legal regulations

All applicable local, regional, national and international legal regulations must be observed.

Waste code to be specified with disposal company.

Proposed waste code:

Product (pieces):	no dangerous waste
Sludge/dusts:	060403 (arsenic containing wastes)
Inert sludge:	190205 (metal hydroxide sludge and other sludge from metal precipitation)
Cleaning waste:	1500202 (contaminated absorption and filter materials, wipes and protective clothing)
Packaging:	no dangerous waste

14. Transport Information

Transport categories:

(ADR/RID; GGVS/GGVE; ADN/ADNR; IMDG/GGVSee; ICAO-TI, IATA-DGR)

Not applicable

14.1 Classification:

UN No. is not assigned

14.2 Correct UN shipping identification:

None

14.3 Transport risk class:

None

14.4 Packaging group:

None

14.5 Environmental perils:

None

14.6 Specific precaution measures for users: Information on transport:

There are no specific traffic rules since gallium arsenide is not hazardous under regular transport conditions (fire and impact of chemicals excluded). This applies also for cases where it is released from package as result of an accident.

14.7 Bulk material transportation pursuant to Annex II of the MARPOL Agreement 73/78 and IBC Code:

Not applicable for packaged commodities.

15. Regulatory Information

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

EC Regulations:

Packaging materials or their components are not subject to Annex XVII; EC 1907/2006

National Regulations:

TRGS 561:	Activities involving carcinogenic metals and their compounds
Employment restrictions:	Youth employment restrictions must be observed. Usage only by persons with technical qualifications
Statutory order on hazardous incidents (12. BImSchV):	Not applicable
Water hazard class:	WGK 3 (self classification): High risk. WGK 3 refers to arsenic and its compounds which are detected after chemical treatment of compact GaAs in waste water.
TRGS 510:	Storage class: 13 (<i>incombustible solid</i>)
Technical Instruction Air (TA-Luft):	Chapter 5.2.7.1.1; class I; Mass flow rate: 0.15 g/h or mass concentration: 0.05 mg/m ³ (stated as As)
Classification according to Industrial Safety Regulation (BetrSichV):	None
15.2 Substance safety assessment:	Executed within the registration of GaAs under REACH

16. Other Information

Revised sections:

- 9.1 Basic physical and chemical properties – thermal deposition
- 10.4 Stability and reactivity - Conditions to be avoided
- 15 Regulatory information – add TRGS 561

Classification:

The classification of gallium arsenide was performed on the basis of new test data determined according to the criteria of EC directive No. 440/2008 of 30.05.2008 about determination of test methods pursuant to EC directive No. 1907/2006 of the European Parliament and the Council for Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) as well as by re-assessment of existing data by FCM in corporation with external expertise.

ABOVE DATA ARE BASED ON THE CURRENT STATUS OF OUR KNOWLEDGE AND EXPERIENCE. THE PRODUCT INFORMATION GALLIUM ARSENIDE, COMPACT DESCRIBES OUR PRODUCT WITH REGARD TO SAFETY REQUIREMENTS AND DOES NOT GUARANTEE ANY PROPERTIES. IT IS THE RESPONSIBILITY OF THE RECEIVER OF OUR PRODUCTS TO OBSERVE ALL LAWS AND LEGAL REGULATIONS.