MATERIAL SAFETY DATA SHEET

1. PRODUCT & COMPANY IDENTIFICATION

1.1	Product Name：	Aluminium Gallium Arsenide (AlGaAs) Chip
	Style/Item No：	GaAlAs (IRA,IRP,IRS,SR,DR,NR,UR TYPE)
1.2	Company Identification：	
	Supplier：	TYNTEK CORPATION
	Name：	Mr. C. K. Perng
	Address：	1378 Ren-Ay Rd.Chunan-Jenn.Miaulih350, Taiwan, R.O.C.
	Telephone：	037-582997
	Facsimile：	037-580866
	e-mail：	187@serv.tyntek.com.tw
1.3	Emergency Contact：	Mr. James Kung
	Telephone：	037-582997
1.4	Manufacturer：	
	Supplier：	TYNTEK CORPATION
	Name：	Mr. C. K. Perng
	Address：	1378 Ren.Ay Rd.Chunan-Jenn.Miaulih350, Taiwan, R.O.C.
	Telephone：	037-582997

2. COMPOSITION/INFORMATION ON INGREDIENTS

2.1	Component：	Epitaxial layer： Aluminium Gallium arsenide(Al(1-X)Ga(X)As) less than 35% $0.2 < X < 1$ Substrate layer：gallium arsenide more than 65%
2.2	Hazard Identification：	T, Toxic
2.3	CAS NO.：	1303-00-0 (GaAs)
2.4	UN Class：	Not assigned
2.5	UN NO.：	Not assigned

3. HAZARDS IDENTIFICATION

3.1	MOST IMPORTANT HAZARDS Adverse Human Health Effects：	Only those arsenic compounds are considered toxic which may result form thermal decomposition and/or chemical reactions of GaAs, esp. －Diarsenic trioxide －Arsenic hydride

Poisoning by arsenic compounds can cause irritation of skin and mucous membranes; can damage heart, liver, blood, nerves and metabolism.

Poisoning may result form inhalation and ingestion of dust and mist which occur when handling substance. As result of thermal decomposition arsenic is released. Arsenic can cause cancer in humans.

4. FIRST AID MEASURES

4.1	Potential routes of exposure	Inhalation, shin, oral, and eye
4.2	After skin contact	Wash with water and soap.
4.3	After eye contact	Wash eyes with plenty of water for at least 15minutes.
4.4	After ingestion	Wash a mouth with plenty of water, and vomit intentionally. Get medical attention.
4.5	After inhalation	Remove form exposure area to fresh air immediately, get medical attention immediately.

5. FIRE FIGHTING MESURES

5.1	General：	Aluminium gallium arsenide epitaxial wafer is nonflammable. It is subject to decomposition at high temperatures.
5.2	Appropriate extinguishing media：	No special extinguishing media needed, adjust extinguishing measures to environment.
5.3	Unsuitable extinguishing media (for safety reasons)	None
5.4	Special hazards caused by substance, combustion products and emerging gases：	Combustion products which are As_2O_3,arsine gas, and arsenic fumes fumes can be hazardous.
5.5	Special protection for fire-fighters：	Respiratory protection because of As_2O_3, arsine, and arsenic fumes.

6. ACCIDENTAL RELEASE MEASURES

6.1	Personal protection：	Take precautions during mechanical working and chemical Reactions. Provide good ventilation in manufacturing rooms, exhausts at machines, avoid skin contact.

6.2 Environmental protection： Do not pass fine-grained AlGaAs epitaxial wafer (suspensions) into Sewerage system (see ＃13.1)

6.3 Methods for cleaning up： Wipe with pulp and place in suitable close containers. Sweep up with special vacuum cleaner and place in suitable close containers.

7. HANDLING AND STORAGE

7.1 Handling, measures for safe handling： Avoid formation of dust and wear gloves when handling. (See ＃6.1)

7.2 Storage, requirements to storage rooms, containers and conditions： Keep dry, close container and store in the roomtemperature

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8. EXPOSURE CONTROL AND PERSONAL PROTECTION

8.1 Design of technical equipment： Provide exhausts/covers for equipment and machines where formation of dust and gaseous arsenic compounds is to be expected.

8.2 Occupational exposure limit： Not available for AlGaAs epitaxial wafer.

Diarsenic trioxide dust.	Determined as arsenic in total			
	OSHA	PEL	TWA	0.01 mg/m^3
	ACGIH	TLV	TWA	0.01 mg/m^3
Arsine	OSHA	PEL	TWA	0.05 ppm
	ACGIH	TVL	TWA	0.05 ppm
Arsenic	OSHA	PEL	TWA	0.01 mg/m3
	ACGIH	TLV	TWA	0.01 mg/m3

8.3 Persnoal protection：

Respiratory protection： Wear Appropriate NIOSH/MSHA approved respirator.

Hand protection： Chemical-resistant gloves

Eye protection： Full facemask for dusts, vapors.

Body protection： Depends on working place(coat, suit, overall, etc.)

8.4 Further information： Avoid skin contact, do not eat, smoke, drink during work, do not keep food in working rooms, wear appropriate clothing, change soiled clothing, wash hands after work.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1	Description：	GaAs
	Appearance：	Solid substance (wafers)
	Color：	Grey with metallic sheen
	Odor：	None
9.2	pH	Not applicable
9.3	Physical and safety data：	Not available for AlGaAs epitaxial wafer
	Melting point/melting area：	1238℃(GaAs)
	Boiling point/boiling area：	Not applicable
	Thermal decomposition：	Begin at approx. 300℃ slightly (GaAs)
	Flash point：	Not applicable
	Inflammability：	Not applicable
	Explosive hazard/limits：	Not applicable
	Fire promoting properties：	Not applicable
	Vapor pressure：	Not applicable
	Density：	5.31g/cm3 at 300K(GaAs)
	Solubility：	Not soluble in water
9.4	Further information	Forms with moisture in presence of atmospheric Oxygen thin, soluble in water, toxic arsenic layer on the surface.

10. STABILITY AND REACTIVITY

10.1	Conditions to avoid：	Heating up in air outside closed equipment.
10.2	Materials to avoid：	Finely divided AlGaAs epitaxial wafer can react vigorously with strong acids and oxidizers. Avoid high temperatures and steam to prevent release of arsenic fumes or arsine gas.
10.3	Hazardous decomposition products and reactions：	AlGaAs epitaxial wafer when exposed to high temperatures or in contact with strong acids or oxidizers can generate toxic arsenic fumes or arsine gas.

11. TOXICOLOGICAL INFORMATION

11.1	Toxicological impact on health：	Animal toxicity： The data of AlGaAs epitaxial wafer is not available. The information of GaAs are as follows.

GaAs				
Intraperitoneal	LD30	(rat)	10	g/Kg

Intraperitoneal LD50 (mouse) 4.7 g/Kg
Inorganic arsenic compounds may be dangerous to human life(oral from 0.6mg/kg)

After inhalation： For human beings the threshold of response to arsenic Compounds (with regard to As in total dust) is：
ACGIH TLV TWA 0.01 mg/m3.
May cause inflammation of mucous membranes in Respiratory tract.

After ingestion： Ingestion of arsenic compounds of 50 μ g/kg/day causes Disturbances of digestive tract and kidneys, changes of blood , skin irritation etc.

After skin contact： Arsenic compounds may cause dermatitis of skin.

11.2 Chronic effect： Arsenic compounds may cause cancer of lungs and skin in human beings.
GaAs was dosed for the hamster in amounts of 0.25mg/time ×1time/week×15weeks,but lung cancer wasn't admitted.

11.3 Carcinogenicity： IARC：Human carcinogen(group 1)
OSHA：Cancer hazard
NTP：Human carcinogen

12. ECOLOGICAL INFORMATION

12.1 Degradability and biodegradability： Not degradable.

12.2 Biological accumulation： Not available

12.3 Toxicity to fish： Not available for AlGaAs,LC50 killifish＞10 μ g/ml(GaAs)

Diarsenic trioxide： LC50 goldfish 32 mg/1/7 days
LC50 water organisms 10-1mg/1/96 hours
Aquatic toxicity rate TLm96：10-1 ppm
5.3 mg/l poisonous for trout after 8 days, from 1 mg/l carcinogen for water organisms.

13. DISPOSAL CONSIDERATIONS

13.1 Product： Compact material is recycled(e.g. controlled thermal decomposition) or disposed according to RCRA Hazardous Waste Regulations or state regulations (in Unitd States).

13.2 Soiled package： Special package for GaAs wafers can be reused after special cleaning, other package contaminated by As to be disposed of in controlled dumps.

14. TRANSPORT INFORMATION

14.1 Transport classification： UN-number Not assigened
(ADR/RID；GGVS/GGVE；AND/ADNR；IMDG/GGVSee; ICAO-TI；IATA-DGR) Not applicable

14.2 Transport information： There are no special regulations since AlGaAs epitaxial wafer is not hazardous under normal transport conditions (fire and impact of acids excluded). This is also true, if AlGaAs epitaxial wafer is released from package in an accident.

15. REGULATORY INFORMATION

Follow all regulations in your country.

16. OTHER INFORMATION

16.1 References：

1) ACGIH TLVs and BEIs Threshold Limit Values for Chemical Substances and Physical Agents(1998)
2) SAX's Dangerous Properties of Industrial Materials (1995)
3) Roschina T.A.：Gig Tr Prof Zabol,10；30-33, (1966)
4) Fadeev A.I.：Gig Tr Prof Zabol,24(3),45, (1980)
5) MSDS Freiberger Compound Materials GmbH (1997)
6) NTP Chemical Repository Gallium Arsenide (Radian Corporation 1990)
7) Ohyama S.：Applied Organometallic Chemistry, 2, 333, (1988)
8) MSDS Hewlett-Packard Opto Electronics Division (1996)