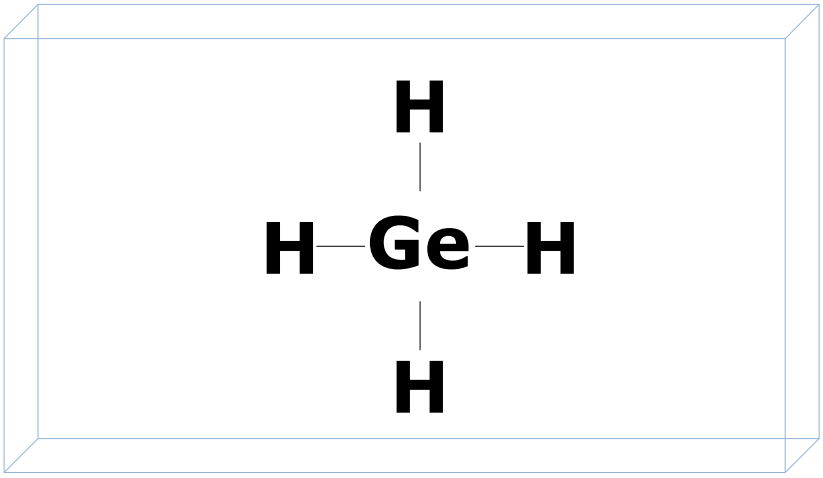
Metaloids
Semiconductor process gases

Germane (GeH_4)

Metaloids makes and supplies germane gas to the microelectronics, photonics and photovoltaics industries. Our mission is to research, synthesize, purify, qualify and package challenging process gases to enable economic manufacturing of high performance electronic devices. We welcome customer feedback and collaboration as critical guides to innovation in our industry. USPTO 7,591,985.



Specifications:

Germane gas purity: 99.9995% minimum *(excl. hydrogen and digermane)*	
Grade	**Electronic/Solar**
Hydrogen	< 30 ppm_v
Nitrogen	< 1.0 ppm_v
Oxygen + Argon	< 0.2 ppm_v
Methane	< 0.1 ppm_v
Carbon dioxide	< 0.1 ppm_v
Carbon monoxide	< 0.1 ppm_v
Digermane	< 20 † ppm_v
Trigermane	< 0.5 ppm_v
Germoxanes	< 1 ppm_v
Chlorogermanes	< 1 ppm_v
Water (Moisture)	< 0.1 ppm_v

Valve outlet	Cylinder Sizes
CGA - 350	49L Steel
DISS - 632	30L Aluminum
JIS – 22L	44L Steel
(All Stainless)	16L Steel
	16L Aluminum
	8L Steel
RFOs are available.	6L Aluminum
	0.44L SS LB

Additional Information
Certificate of analysis provided for each cylinder
Cylinder valve outlets are tapped for optional RFO devices.
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†**Adjustable in solar cell applications up to 200ppm to meet specific customer requirement.**

Applications:

Germane gas is a source of hyper-pure germanium in the chemical vapor deposition and molecular beam epitaxy of amorphous germanium layers, silicon-germanium (SiGe) and boron-germanium alloys. The first practical integrated circuit was fabricated using germanium as

semiconductor by Physics Nobel Laureate Jack Kilby in 1958. By virtue of a larger atomic radius, germanium induces strain in adjacent layers of silicon, thereby increasing the mobility of charge carriers in silicon, which in turn, improves performance and power consumption in microprocessors. This basic discovery makes germanium important for high performance complementary metal oxide semiconductors and SiGe technologies associated with heterojunction bipolar transistors for high speed digital communications such as broad band and cell phones. Other applications include photon detectors, solar cells, quantum dots and LEDS.

Our Capabilities:

Statistical process and quality control systems in our operations enable higher yields, improved selectivity and consistent purities. Metaloids networks with qualified distributors to reach customers worldwide. We are a team and process technology driven organization that understands the health, safety and environmental aspects of specialty chemical plant operation.

Physical Properties:

Germane (GeH_4) or germanium hydride gas is colorless, toxic and has a pungent odor. The gas readily burns in air to produce oxides of germanium and hydrogen.

Molar mass	76.622 g/mol
Boiling point	-88.4°C
Specific volume	90.202 grams/SCF (=0.199 lb/SCF)
Melting point	-165°C
Vapor pressure	640 psia at 21°C
Auto-ignition temp.	87.8ºC
Critical temperature	34.8°C
Critical pressure	805.3 psia
OEL / IDLH	0.2ppm / 20-30ppm
Material compatibility	Stainless steels, carbon steel, Kalrez, KelF, PVC, PVDF, PTFE, Viton®

Registered Trademark of DuPont Dow Elastomers.

Shipping Information:

DOT Name	Germane, Compressed
Hazard Class	2.1, 2.3
ID No.	UN2192
DOT Label	Flammable, toxic inhalation hazard
CAS	7782-65-2
Packing Group	I
RTECS	LY1900000
MDL	MFCD00011028
PubChem ID	24869887
EG/EC	231-961-6

Product Information:

Metaloids supplies germane gas as a compressed pure component at 99.999% purity or a blend with carrier gas(es), chosen by end-user from hydrogen, deuterium, argon, nitrogen to helium. Carrier gases are at 6N or 99.9999% certified purity unless limited by supply and authorized by end-user.

Production Plant: **Metrocrest Industrial Park, Terrell, Texas, USA**

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