

IM-94-12

OREGON OCCUPATIONAL SAFETY AND HEALTH DIVISION DEPARTMENT OF INSURANCE AND FINANCE

INDEXED MEMO

Indexed Memo IM-94-12
Issued(PD) August 1, 1980
Issued(IM) March 21, 1994

SUBJECT: Silane Gas (Silicon Tetrahydride)

AFFECTED CODES/
DIRECTIVES:

CGA Pamphlet P-1-1991, Division 2/Z 1910.1200

(1) PURPOSE: To provide information to compliance officers and users of silane on the explosive hazard of silane gas.

(2) BACKGROUND: A. Silane is used in the manufacture of semiconductor devices for the electronics industry. Under many conditions, silane has spontaneously ignited or exploded upon reaction with atmospheric oxygen. Reactions tend to occur in mixtures of silane with static air, typically after shutting off silane flow into an air space. No lower and upper flammability limits of silane in air appear to exist.

B. Properties of Silane

Formula: SiH
Description: A colorless gas with a repulsive odor. Spontaneously flammable in air.
Molecular Weight: 32.112
Specific Volume: (700 F, 1 atm) 12.0 cu. ft./lb.
 (749.1 ml/g)
Boiling Point: (1 atm) -1120 C (-169-60 F)
Freezing Point: (1 atm) -185* C (-301* F)
Gas Density: (0C, 1 atm) 1.44 g/l
Liquid Density: (-185 C) 0.68 g/ml

Critical Temperature: -4 C (24.80 F)

Critical Pressure: 49.3 kg/cm² absolute
 (47.8atm), (702.7 psi)

C. The following concentrations of silane in dilution gases represent the minimum concentrations at which a visible ignition was noted upon release of the silane gas mixture in air:

1. 2% silane in argon
2. 2.5% silane in nitrogen
3. 3% silane in hydrogen

No significant difference was noted when temperature and humidity were varied.

D. A burning stream of silane gas mixture may be extinguished as the gas stream velocity increases. If a non-burning stream of silane is slowed to a critical velocity, the gas stream will self-ignite. The critical velocity depends on the gas mixture.

E. The explosion potential of silane gas may be reduced by:

1. Maintaining a continuous ignition source at all potential leakage sites (where other flammables are not in use).
2. Maintaining an air flow of approximately 100 lineal fpm across all potential leak sites to ignite the gas as it is liberated and to prevent explosive gas build up.
3. Using concentrations of silane of less than 2% in dilution gas will assure insufficient silane to result in flame generation or the build up of explosive quantities of unreacted silane.

(3) ACTION: The above information will be used to evaluate the injury potential due to procedures involving the use of silane.

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