

SEMI C57-0305

SPECIFICATIONS AND GUIDELINES FOR ARGON

This specification was technically approved by the Global Gases Committee and is the direct responsibility of the North American Gases Committee. Current edition approved by the North American Regional Standards Committee on December 10, 2005. Initially available at www.semi.org January 2005; to be published March 2005.

NOTICE: This document replaced SEMI C3.1, SEMI C3.42, and SEMI C3.46 in 2005.

1 Purpose

1.1 The purpose of this document is to provide a series of specifications for different grades of Argon (Ar) that are used in the semiconductor industry.

2 Scope

2.1 This document covers requirements for all grades of Argon used in the semiconductor industry.

2.2 If analytical methods are not complete, the requirements are presented as a guideline.

NOTICE: This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.

3 Description

3.1 Argon is the most abundant member of the rare gas family. It is monatomic and is characterized by its extreme chemical inactivity. Argon is a colorless, odorless and tasteless gas somewhat soluble in water. It is normally delivered and stored as a cryogenic liquid.

4 Limitations

4.1 None.

5 Referenced Standards

5.1 SEMI Standards

SEMI C1 — Specifications for Reagents

SEMI C3 — Specifications for Gases

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions

6 Terminology

6.1 Terminology appropriate to this standard is defined in SEMI C3.

7 Requirements

7.1 Purity and other requirements for the various grades of Argon are given in Table 1.

Table 1 Impurity and Other Requirements for Various Grades of Argon

<i>Previous SEMI Reference #</i>	<i>C3.1-1101 (Specification)</i>	<i>C3.46-1102 (Specification)</i>	<i>C3.42-90 (Guideline)</i>
Grade	4.8	5.2	6.0
Purity	99.998%	99.9992%	99.99990% ^{#1}
Impurities	Maximum Acceptable Level (ppm) ^{#2}		
Carbon monoxide and carbon dioxide (CO + CO ₂)	0.5	0.5	N/A
Carbon Dioxide (CO ₂)	N/A	N/A	0.05
Carbon Monoxide (CO)	N/A	N/A	0.05
Hydrogen (H ₂)	1	1	0.10
Nitrogen (N ₂)	10	5	0.5
Oxygen (O ₂)	2	0.5	0.05
Total Hydrocarbons expressed as Methane (THC)	0.5	0.5	0.1
Water (H ₂ O) (v/v)	1	0.5	0.1
TOTAL SPECIFIED IMPURITIES	15	8	0.95
Particles	^{#3}	^{#3}	^{#3}

^{#1} A purifier is allowed to be used to meet this specification.

^{#2} An analysis of significant figures has not been considered. The number of significant figures is based on analytical accuracy and the precision of the provided procedure.

^{#3} To be determined between supplier and user.

8 Physical Constants

8.1 The physical constants of argon are given in Table 2 (for information only).

Table 2 Physical Constants of Argon (for information only)

	<i>Metric Units</i>	<i>US Units</i>
Molecular weight	39.948	39.948
Boiling point at 1 atm	−185.9°C	−302.6°F
Density of gas at 21.1°C (70°F) and 1 atm	1.656 kg/m ³	0.1034 lb/ft ³
Specific gravity of gas at 21.1°C and 1 atm (air = 1)	1.38	1.38
Density of liquid at boiling point	139 kg/m ³	8.698 lb/ft ³

9 Analytical Procedures for Grade 4.8 Argon

NOTE 1: Introduce the calibration standard as many times as necessary to achieve the desired precision.

NOTE 2: All gases used in the analysis of the sample should contain no more than 10% of the sample value of the component of interest unless otherwise specified.

9.1 *Carbon Monoxide and Carbon Dioxide* — This procedure is for the determination of carbon monoxide and carbon dioxide in argon using a gas chromatograph with a flame ionization detector and methanizer.

9.1.1 *Detection Limit* — 100 ppb

9.1.2 *Instrument Parameters*

9.1.2.1 *Column*: Porapak T or Q, 3 m (9.8 ft) by 3.2 mm (1/8 in) OD by 2.2 mm (0.085 in) ID stainless steel; or Chromosorb 102, 2 m (6.6 ft) by 3.2 mm (1/8 in) OD by 2.2 mm (0.085 in) ID stainless steel; or equivalent.

9.1.2.2 *Carrier Flow*: 30 mL/min helium