

SEMI C57-0317

SPECIFICATION FOR ARGON

This Standard was technically approved by the Gases Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on December 8, 2016. Available at www.semiviews.org and www.semi.org in March 2017; originally published March 2005; previously published February 2011.

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.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents 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 and Documents

5.1 *SEMI Standards and Safety Guidelines*

SEMI C1 — Guide for the Analysis of Liquid Chemicals

SEMI C3 — Specification 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

Previous SEMI Reference #	C3.1-1101	C3.46-1102	C3.42-90
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

<i>Previous SEMI Reference #</i>	<i>C3.1-1101</i>	<i>C3.46-1102</i>	<i>C3.42-90</i>
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
CAS Number	7440-37-1	7440-37-1
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.

9.1.2.3 *Sample Volume* — 0.5 to 2.0 mL.

9.1.2.4 *Temperatures*

- *Detector* — 280°C.
- *Column Oven* — 60°C.
- *Methanizer* — 350°C.