

SEMI C52-0301 (Reapproved 0312)

SPECIFICATION FOR THE SHELF LIFE OF A SPECIALTY GAS

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 24, 2011. Available at www.semiviews.org and www.semi.org in March 2012; originally published March 2001.

NOTICE: This Document was reapproved with minor editorial changes.

1 Purpose

1.1 The purpose of this Document is to define terminology and to recommend minimum periods for the shelf lives of specialty gases. It is meant to provide consistency in terminology among gas suppliers and to provide a general guideline for users of these gases.

2 Scope

2.1 This Document applies to the shelf life of properly packaged, filled and analyzed specialty gases as stored or supplied by a specialty gas manufacturer or supplier. In this Document, shelf life is viewed from a quality point of view. The Document does not address safety aspects associated with the prolonged storage of gases.

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 Referenced Standards and Documents

3.1 None.

4 Terminology

4.1 Definitions

4.1.1 *container* — a lecture bottle, cylinder, cylinder pack, drum or any other vessel which is used to supply a specialty gas.

4.1.2 *residual level* — the amount of product, as a fraction of the fill weight or fill pressure, which should be left in a container in order to minimize the impact on manufacturing processes of the higher level of impurities in the last gas fraction from a container.

4.1.3 *shelf life* — the period of time for which the specification of a gas is guaranteed by the supplier, starting from the time of analysis. It defines the period for which the supplier guarantees the actual level of impurities, as analyzed, to remain at or below the specification limit for a particular gas grade.

5 Requirements

5.1 *Factors Affecting the Shelf Life of a Specialty Gas* — Shelf life is a function of the following factors:

1. Thermal stability of the gas
2. Quality of the container and valve
 - material selection
 - leak tightness
3. Time-dependent reactions between
 - gas and impurities
 - gas and packaging materials
4. Filling and analytical operations
5. Transport and storage conditions

6. Amount of product in the container

5.1.1 The integrity of the valve is a key factor determining the shelf life of a gas, in particular for low vapor pressure gases. Time dependent reactions can be significantly reduced by purification of the gas to a level where impurities no longer have a significant effect over time, and by selection of proper packaging materials. Chemical and physical treatment of the internal container surface and/or passivation of this surface before filling also reduces the effect of time-dependent reactions. For material and gas compatibility information, please refer to the individual SEMI gas Standards.

5.2 *Classification of Specialty Gases on the Basis of Shelf Life* — While there are a large number of specialty gases used in semiconductor manufacturing, for the purpose of defining shelf lives, they can be divided into four groups. It should be noted that for example chemically reactive gases are sometimes classified as non-reactive in the table below as the classification is done from a shelf-life point of view only.

5.2.1 *Non-Reactive* — Under normal storage conditions, these gases do not react with ambient air, the packaging materials or the impurities commonly found in the specialty gas.

5.2.2 *Reactive* — These gases react either with ambient air or standard packaging materials.

5.2.3 *Corrosive* — These gases react with packaging materials usually in the presence of traces of moisture.

5.2.4 *Unstable* — These gases are thermally unstable and spontaneously decompose over time.

Table 1 Classification of Specialty Gases on the Basis of Shelf Life

<i>Non-Reactive</i>	<i>Reactive</i>	<i>Corrosive</i>	<i>Unstable</i>
Air	AsH ₃	BCl ₃	B ₂ H ₆
Ar	CO	BF ₃	NO
CFH ₃	D ₂	¹¹ BF ₃	
CF ₂ H ₂	GeH ₄	ClF ₃	
CF ₃ H	H ₂	Cl ₂	
CF ₄	NF ₃	F ₂	
CH ₄	PH ₃	GeF ₄	
CO ₂	SeH ₂	HBr	
C ₂ F ₆	SiH ₄	HCl	
C ₃ F ₈	Si ₂ H ₆	HF	
C ₄ F ₈		NH ₃	
C ₅ F ₈		PF ₅	
He		SiCl ₂ H ₂	
Kr		SiCl ₃ H	
Ne		SiCl ₄	
N ₂		SiF ₄	
N ₂ O		WF ₆	
O ₂			
SF ₆			
Xe			