

SEMI C67-0811 (Reapproved 0317) GUIDE FOR HAFNIUM AMIDES

This Standard was technically approved by the Liquid Chemicals 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 August 2011.

1 Purpose

1.1 The purpose of this Document is to provide a guide for hafnium amides for which a need has been identified.

2 Scope

2.1 The scope of this Document covers high purity hafnium amides, namely, tetrakis(dimethylamino) hafnium, tetrakis(diethylamino) hafnium and tetrakis(ethylmethylamino) hafnium which are used in the semiconductor industry for the deposition of hafnium oxide based layers by atomic layer deposition.

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 Limitations

3.1 None.

4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

SEMI C1 — Guide for the Analysis of Liquid Chemicals

4.2 *ASTM Standard*¹

ASTM D5127 — Standard Guide for Ultra Pure Water Used in the Electronics and Semiconductor Industry

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

5 Terminology

5.1 *Abbreviations and Acronyms*

5.1.1 *NMR* — nuclear magnetic resonance

5.1.2 *TDEAH* — tetrakis(diethylamino) hafnium

5.1.3 *TDMAH* — tetrakis(dimethylamino) hafnium

5.1.4 *TEMAH* — tetrakis(ethylmethylamino) hafnium

5.1.5 *TMS* — tetramethylsilane

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA; Telephone: +1.610.832.9585, Fax: +1.610.832.9555, <http://www.astm.org>

6 Properties

Table 1 Properties of TDMAH (for information only)

Molecular Formula	$\text{Hf}[\text{N}(\text{CH}_3)_2]_4$
Molecular Weight	354.79 g/mol
CAS Number	19782-68-4
Boiling Point	60°C at 0.01 mmHg
Vapor Pressure (P = mmHg, T = K)	$\log_{10}P = 9.9457 - 3270.81/T$
Melting Point	26°C to 29°C
Solubility in Water	Reacts
Appearance	Colorless solid

Table 2 Properties of TDEAH (for information only)

Molecular Formula	$\text{Hf}[\text{N}(\text{CH}_2\text{CH}_3)_2]_4$
Molecular Weight	467.1 g/mol
CAS Number	19824-55-6
Boiling Point	130°C at 0.01 mmHg
Vapor Pressure (P = mmHg, T = K)	$\log_{10}P = 7.3066 - 2896.1/T$
Melting Point	Liquid at 25°C
Liquid Density at 25°C	1.249 g/cm ³
Solubility in Water	Reacts
Appearance	Yellow/orange liquid

Table 3 Properties of TEMAH (for information only)

Molecular Formula	$\text{Hf}[\text{N}(\text{CH}_2\text{CH}_3)(\text{CH}_3)]_4$
Molecular Weight	410.98 g/mol
CAS Number	352535-01-04
Boiling Point	79°C at 0.1 mmHg
Vapor Pressure (P = mmHg, T = K)	$\log_{10}P = 9.447 - 3432.3/T$
Melting Point	Liquid at 25°C
Liquid Density at 25°C	1.324 g/cm ³
Solubility in Water	Reacts
Appearance	Pale yellow liquid

7 Suggested Values

7.1 The suggested values for hafnium amides for Tier A are listed in Table 4.

8 Grade 1 Procedures

8.1 This section does not apply to this chemical.

9 Grade 2 Procedures

9.1 This section does not apply to this chemical.