

SEMI C66-0317

GUIDE FOR TRIMETHYLALUMINUM (TMAI), 99.5% QUALITY

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 February 2008.

1 Purpose

1.1 The purpose of this Document is to provide a guide for trimethylaluminum (TMAI) used in the semiconductor industry.

2 Scope

2.1 The scope of this Document covers a Tier of high purity TMAI, which is used in the semiconductor industry for the deposition of aluminium metal by vapor deposition techniques and aluminium 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 Industries

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

5 Terminology

5.1 *Abbreviations and Acronyms*

5.1.1 *ICP-OES* — inductively coupled plasma optical emission spectrometry

5.1.2 *ICP-MS* — inductively coupled plasma mass spectrometry

5.1.3 *NMR* — nuclear magnetic resonance

5.1.4 *PFA* — perfluoroalkoxy alkane polymer

5.1.5 *TMAI* — trimethylaluminum

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6 Properties

Table 1 Properties of TMAI

Molecular Formula	Al(CH ₃) ₃
CAS Number	75-24-1
Molecular Weight (g/mol)	72.09
Boiling Point (°C)	127
Freezing Point (°C)	15
Liquid density at 20°C (g/mL)	0.75
Solubility in water	Reacts violently
Appearance	Pyrophoric colourless liquid

7 Suggested Values

7.1 The suggested values for TMAI for Tier A are listed in Table 2.

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.

10 Grade 3 Procedures

10.1 This section does not apply to this chemical.

11 Grade 4 Procedures

11.1 This section does not apply to this chemical.

12 Tier A Procedures

12.1 Standardized test methods are being developed for all parameters at the purity level indicated. Until standardized test methods are published, test methodology shall be determined by user and producer. The Liquid Chemicals Global Technical Committee considers a method to be valid only if method validation according to SEMI C1 has been demonstrated.

12.2 *Trace Metals Analysis* — The following method can be used in determining trace metal impurities at the specified value for the elements listed in Table 2. Alternate methods may be used as long as validation according to SEMI C1 is demonstrated.

12.2.1 *Special Reagents* — All water used in the trace metals analysis should be deionized water meeting the criteria for Type E1.1 in ASTM D5127.

12.2.2 *Mixed Acid* — 1% HF – 2% HNO₃ prepared by dilution of ultra pure acids with appropriate weights of deionized water.

12.2.3 *Standards* — Composite standard solutions containing 0, 1, 2, and 4 ppb multi-element standards are prepared by diluting with mixed acid of appropriate weights for inductively coupled plasma mass spectrometry (ICP-MS). Single-element standard (Si) is prepared for inductively coupled plasma optical emission spectrometry (ICP-OES).

12.2.4 *Sample Preparation* — In a clean environment, place 10 g of sample in a clean perfluoroalkoxy alkane polymer (PFA) closed bottle equipped with an inlet and outlet tube and evaporate under a nitrogen purge at 25°C. When dry, close the inlet and the outlet tube and digest the residue at 100°C for 30 minutes with 5 mL of mixed acid solution. Cool and transfer the contents with deionized water. Dilute the transferred contents with deionized water to a final volume of 25 mL.