

SEMI HB11-0819

SPECIFICATION FOR SAPPHIRE SINGLE CRYSTAL INGOT INTENDED FOR USE FOR MANUFACTURING HB-LED WAFERS

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1 Purpose

1.1 The sapphire single crystal ingot is used as a substrate material for HB-LED applications. To permit common processing equipment to be used in multiple device fabrication lines, it is essential for the sapphire single crystal ingot specifications to be standardized.

1.2 This Specification provides the characteristics of sapphire single crystal ingot, consisting of the physical specification, orientation, shape, and defect standard.

2 Scope

2.1 This Specification is the requirement for key parameters and the defects of sapphire single crystal ingots only used for manufacturing wafers for HB-LED applications.

2.2 The key parameters cover the ingot diameter, reference plane width, end face orientation, reference plane orientation, verticality, and roundness.

2.3 The defects which need to be deducted along the axial direction of the sapphire single crystal ingot, consist of bubbles and cloud, surface scratch, crack, and chip.

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 SEMI Standards and Safety Guidelines

SEMI HB8 — Test Method for Determining Orientation of a Sapphire Single Crystal

SEMI HB10 — Specification for Single Crystal Sapphire Intended for Use for Manufacturing HB-LED Wafers

SEMI M40 — Guide for Measurement of Roughness of Planar Surfaces on Polished Wafers

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

4 Terminology

4.1 Definitions

4.1.1 *bubble* — a crystal defect that exists in single crystal sapphire that presents itself as a void in the crystal, and includes gaseous and vacuum voids.

4.1.2 *end face* — the end face is a planar face at the end of sapphire ingot perpendicular to the axis. The ingot has two end faces, the upper one is labelled as E1, and the other is labelled as E2 shown in the diagram (see Figure 1).

4.1.3 *reference plane* — the plane or groove, which is vertical to the end face of ingot, is also defined as the orientation flat for sliced wafers.

4.1.4 *roundness* — the difference between the maximum diameter and the minimum diameter of the ingot, when both are measured at the same distance from an end face of the ingot cylindrical surface.

4.1.5 *verticality* — an angle that quantifies the deviation from the perpendicular intersection between the ingot's end face and the reference plane, and same to the relationship of end face and cylindrical surface of ingot.

NOTE 1: The definitions of chip and crack should be referenced to SEMI HB10.

5 Test Methods

5.1 The geometrical parameters of ingot length, ingot diameter and width of reference plane can be directly measured by a ruler and a set of triangular plates or a digital caliper.

5.2 The orientation of end face, reference plane, shall follow the standard of SEMI HB8.

5.3 The test standard of end surface and cylindrical surface roughness refers to SEMI M40.

5.4 The test method of defects can be mutually determined by the suppliers and customers.

NOTE 2: The test methods of sapphire ingot parameters can be negotiated by the suppliers and customers. The operation details of methods are not available in this Specification.

6 Ordering Information

6.1 Purchase orders for sapphire ingot provided under this Specification shall include the following items. Schematic diagram of the sapphire single crystal ingot is shown in Figure 1.

6.1.1 Growth method (customer and supplier options).

6.1.2 Diameter (D), reference plane width (W).

6.1.3 End face (E1 and E2) and reference plane orientation.

6.1.4 The total effective length of single crystal ingot of sapphire is a difference of the total ingot length and defect length.

6.2 The following items may be specified optionally in addition to those listed in § 6.1.

6.2.1 Verticality, roughness (end face and cylindrical surface), roundness.

6.2.2 The limitation for the length percentage of ingot with defects.

6.2.3 Acceptable defect size such as surface scratch, bubble and cloud, chip and crack.

6.3 In addition, for the parameters mentioned above and requirements, the customer can refer the Tables 1, 2, and 3. In the case of sapphire ingots with other diameters, details can be negotiated by customer and supplier.

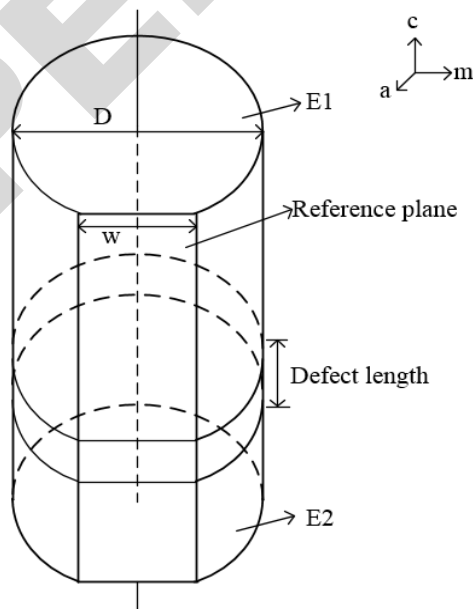


Figure 1
Schematic Diagram of the Sapphire Single Crystal Ingot