

SEMI HB12-1219

SPECIFICATION FOR DRY-ETCHED PATTERNED SAPPHIRE SUBSTRATES (DPSS)

This Standard was technically approved by the HB-LED Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on August 19, 2019. Available at www.semiviews.org and www.semi.org in December 2019.

1 Purpose

1.1 As the high brightness light emitting diode (HB-LED) and patterned sapphire substrate (PSS) industry is under rapid development, it is very necessary to establish the standard for PSS products, which can provide a clear and common basis to meet the demands of research and development, production and sale for light emitting diode (LED) industry. Because the PSS industry belongs to the upstream in the whole LED industry, a sound standard and specification system is beneficial to the downstream of LED industry. This Standard intends to specify the terms, definitions and the specifications of pattern parameters (such as height, width and pitch, etc.) for dry-etched patterned sapphire substrates.

2 Scope

2.1 Terms, definitions and specifications of pattern parameters will be specified for dry-etched patterned sapphire substrates.

2.2 This Standard applies to patterned sapphire substrates for semiconductor GaN epitaxial light-emitting diodes production.

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 *dry etching patterned sapphire substrate (DPSS)* — pattern sapphire substrate processed by dry etching.

4.1.2 *edge exclusion* — the distance from the fixed quality area boundary to the periphery of a wafer of nominal dimension.

4.1.3 *pattern* — the micro- or nano-scale geometrical structures (e.g., cone) on the surface of sapphire substrate.

4.1.4 *pattern bilateral symmetry* — the symmetry of a pattern on the center plane of itself. The pattern bottom diameter is divided into two halves from the center, one half of length A and other half of length B, | A-B | represents the magnitude of symmetry. Refer to Figure 4.

4.1.5 *pattern bottom angle* — The included angle between the pattern triangular cone and the planar base of the etching. Refer to Figures 5 and 6.

4.1.6 *pattern bottom diameter* — the diameter of pattern bottom circle on the planar base of the etching.

4.1.7 *pattern defect* — missing pattern or disordered pattern, etc., on the surface of wafer.

4.1.8 *pattern height* — the normal height of the pattern based on the plane of the sapphire substrate.

4.1.9 *pattern pitch* — the distance between the geometric centers of adjacent pattern features on PSS.

4.1.10 *patterned sapphire substrate (PSS)* — sapphire substrate with periodically arrayed patterns on the surface.

4.1.11 *surface particle* — the impurities or stains, etc., on the surface of DPSS.

5 Test Method

5.1 The value of the attribute must be determined by a method agreed upon by the supplier and the purchaser.

6 Requirements

6.1 Pattern Parameters of DPSS

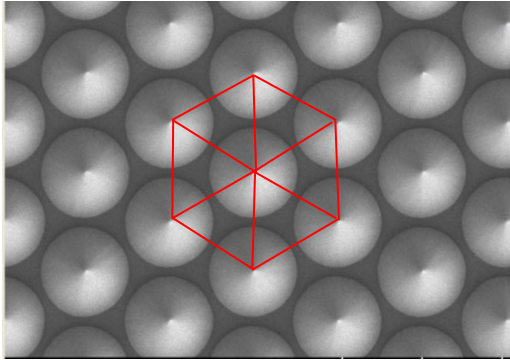


Figure 1
Pattern Arrangement

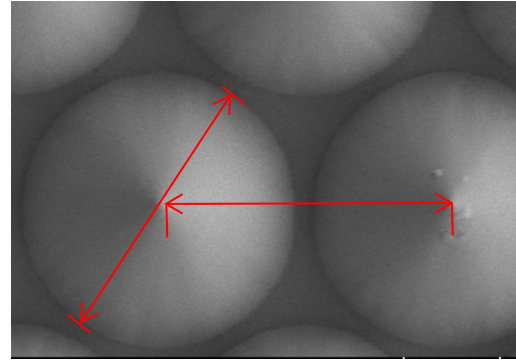


Figure 2
Pattern Pitch and Pattern Bottom Diameter

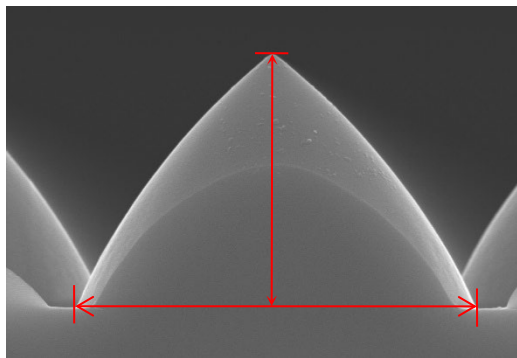


Figure 3
Pattern Height and Pattern Bottom Diameter

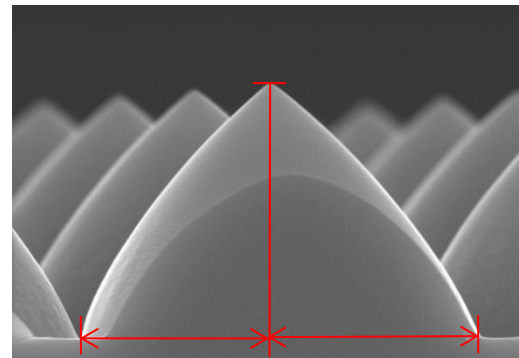


Figure 4
Bilateral Symmetry of Pattern | A-B |

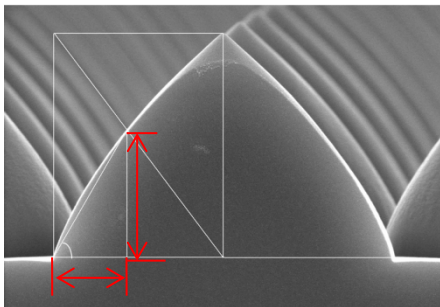


Figure 5
Pattern Bottom Angle Schematic Diagram

Trigonometric function

$$\theta = \text{atan} \frac{R_y}{R_x}$$

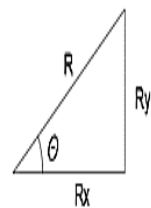


Figure 6
Pattern Bottom Angle Trigonometric Function