

# SEMI D9-0303 (Reapproved 0515) TERMINOLOGY FOR FLAT PANEL DISPLAY (FPD) SUBSTRATES

This Standard was technically approved by the Flat Panel Display – Materials & Components Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on January 5, 2015. Available at [www.semiviews.org](http://www.semiviews.org) and [www.semi.org](http://www.semi.org) in May 2015; originally published in 1994; previously published July 2009.

**NOTICE:** This Document was reapproved with minor editorial changes.

## 1 Purpose

1.1 This Document provides terms and definitions of materials and defects within and on the surface of flat panel display (FPD) substrates and of dimensional, thermal, chemical, optical and mechanical properties of FPD substrates.

## 2 Scope

2.1 These terms and definitions are applicable to both front and back substrates used in FPD fabrication.

**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 D3 — Quality Area Specification for Flat Panel Display Substrates

SEMI D5 — Standard Size for Flat Panel Display Substrates

SEMI D7 — FPD Glass Substrate Surface Roughness Measurement Method

SEMI D11 — Specification for Flat Panel Display Glass Substrate Cassettes

SEMI D12 — Specification for Edge Conditions of Flat Panel Display (FPD) Substrates

SEMI D15 — FPD Glass Substrate Surface Waviness Measurement Method

SEMI D24 — Specification for Glass Substrates Used to Manufacture Flat Panel Displays

### 3.2 ASTM Standards<sup>1</sup>

ASTM C336 — Standard Test Method for Annealing Point and Strain Point of Glass by Fiber Elongation

ASTM C338 — Standard Test Method for Softening Point of Glass

ASTM C598 — Standards Test Method for Annealing Point and Strain Point of Glass by Beam Bending

### 3.3 SEAJ Documents<sup>2</sup>

SEAJ Liquid Crystal Display Manufacturing Equipment Dictionary

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

<sup>1</sup> 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>

<sup>2</sup> Semiconductor Equipment Association of Japan, 6F Rokubancho SK Building, 3 Rokubancho, Chiyoda-ku, Toyko 102-0085, Japan; Telephone: +81.3.3261.8260, Fax: +81.3.3261.8263, <http://www.seaj.or.jp>

## 4 Terminology

NOTE 1: SEAJ Liquid Crystal Display Manufacturing Equipment Dictionary is referred as to every term in § 4.

### 4.1 *Internal Defects*

4.1.1 *bubble* — a gaseous inclusion.

4.1.2 *open bubble* — a gaseous inclusion which is so close to the surface that it is obviously open and/or one so close to the surface that it may be broken open with the point of a soft lead pencil.

4.1.3 *inclusion* — opaque or partially melted particle of refractory or batch material embedded in glass. Its size is usually determined by the size of the distorted area.

4.1.4 *devitrification* — a crystalline area within the glass.

4.1.5 *knot* — an embedded glassy, transparent, lump having an irregular or tangled appearance. Its size is usually determined by the size of the distorted area.

### 4.2 *Material on the Surface*

4.2.1 *cullet* — small transparent glass particles that are adhered or fused to the glass substrate surface.

4.2.2 *particle* — a micron-size piece of foreign material on the glass surface.

4.2.3 *stain* — organic or inorganic material on the surface.

4.2.4 *blur* — any erosion of the surface; generally cloudy in appearance, it sometimes exhibits an apparent color.

### 4.3 *Surface Defects*

4.3.1 *scratch* — a surface fissure generally caused during handling.

4.3.2 *sleek* — a very shallow type of scratch on the polished surface that is sometimes invisible when the viewing angle is changed.

4.3.3 *latent scratch* — a scratch which is usually invisible but when subjected to an etching action by dipping into a detergent or a corrosive solution, such as an acid, the previously invisible scratch becomes visible due to the minor removal of surface glass.

4.3.4 *chip* — a region of material missing from the edge of the glass substrate, which is sometimes caused by processing or handling.

4.3.5 *pit/dig* — small indentation on the glass substrate surface.

4.3.6 *bump* — a small protuberance on the glass substrate.

4.3.7 *crack* — a fissure located at the sheet edge area or central area.

4.3.8 *streak* — a defect with a very small undulation on the glass substrate surface.

### 4.4 *Dimensional Properties*

4.4.1 *outsize dimension* — vertical and horizontal dimensions of the glass substrate.

4.4.2 *thickness* — the distance between the front surface and the back surface of a glass substrate at same single point.

4.4.3 *thickness variation* — any differences between maximum and minimum values within the thickness of a glass substrate.

4.4.4 *warp* — defined as the maximum distance from a reference plane to the guaranteed surface; this includes twists, partial rises or declines in the glass compared with the reference plane. Warp expression a condition of the whole glass (substrate).

4.4.5 *waviness* — the residual unevenness after the long wavelength component (warp) and the short wavelength component (surface roughness) have been eliminated. This is also called 'FPD Waviness' when referring specifically to FPD substrates, as in SEMI D15.