

SEMI D13-1101

TERMINOLOGY FOR FPD COLOR FILTER ASSEMBLIES

This Standard was technically approved by the Flat Panel Display Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on April 19, 2001. Available at www.semi.org in November 2001; originally published in 1995.

1 Purpose

1.1 These terms and definitions describe various elements and characteristics of FPD color filter (CF) assemblies. They are intended to assist in future CF standardization activity.

2 Scope

2.1 Color filters comprise the front plate assembly in a colored flat panel display. They consist of a number of material layers such as glass substrate, color filter layer, black matrix, overcoat layer, and indium tin oxide (ITO) films. Each of these layers has various properties which may need to be specified, produced, controlled, and characterized. This Document provides an overview of these layers, with terms and definitions for selected elements, and indicates the appearance of some color filter defects. This Document may be useful in developing material specifications, inspection criteria, and test methods.

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 This Document does not contain detailed measuring and test methods. Such methods may be developed separately, and references to them may be incorporated into color filter specification documents where appropriate. The assembly of color filters into a flat panel display assembly is not covered herein.

4 Referenced Standards and Document

4.1 SEMI Standards

SEMI D3 — Quality Area Specification for Flat Panel Display Substrates

SEMI D20 — Defect Terminology for Flat Panel Display Masks

SEMI D21 — Terminology for Flat Panel Display Masks

SEMI M21 — Specification for Assigning Addresses to Rectangular Elements in a Cartesian Array

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

5 Color Filter Elements (see Figure 1)

5.1 *alignment control projection* — a rib-shaped protrusion created within the display pixel on the color filter film surface for the purpose of controlling alignment direction of the liquid crystal.

5.2 *backside ITO film* — a thin film of indium tin oxide formed on the glass surface on the back of the color filter substrate.

5.3 *black matrix (BM)* — layer which blocks light transmission. It provides a boundary between color filter pixels, preventing the transmitting light between adjacent pixels.

5.4 *color filter layer* — colored layer through which light is transmitted. It is deposited in three colors—red, green, and blue—which are patterned to produce an array of contiguous, rectangular, or square-shaped pixels.

5.5 *glass substrate* — the base material onto which black matrix and color filter layer are deposited. Also called the front plate. After assembly into a display, its back surface faces the observer. See SEMI D3 and SEMI D21 for parameters, definitions, and dimensional specifications.

5.6 *ITO Film* — a thin film of indium tin oxide.

5.7 *overcoat layer* — transparent material deposited over the color filter material. This provides a smooth surface and enough adhesion for subsequent ITO material deposition.

5.8 *post spacer* — a fixed pillar-shaped spacer formed outside of the pixel opening.

5.9 *reflective film* — a light-reflective layer created on the color filter substrate below the color filter layer.

6 Color Filter Pixel (RGB) Layout

6.1 The color filter pixels are arranged in one of several array patterns. The array is constructed from m vertical columns and n horizontal rows of identical pixels of dimensions a horizontally and b vertically. The number of pixels in different rows and columns may vary to suit the application. These are illustrated in Figure 2.

7 Color Filter Types and Fabrication Methods

7.1 Fabrication Methods

7.1.1 *photolithography* — patterning method by using micro photolithograph machines and photopatternable materials. Precise patterns can be formed.

7.1.2 *color photoresist method* — defined as color photoresist, it is possible to create a pattern through a direct exposure method using color pigment or dye dispersed on a photoresist.

7.1.3 *dyeing* — dyeable photoresist materials are patterned by photolithographic image processing. These patterned materials are dyed by a special method. The various colors may be introduced sequentially.

7.1.4 *etching* — dye or pigment-dispersed color material is coated on substrate, and it is patterned by photolithographic etching method.

7.1.5 *printing* — pigment-dispersed color ink is placed and patterned on the substrate by printing method.

7.1.6 *electric deposition* — micro cells encapsulating pigment particles are dispersed in water solvent and deposited on the selected electrode on glass substrate.

7.1.6.1 *patterned ITO method* — color filter layers are accumulated using a micell distribution liquid for each color of the ITO pattern formed according to the various RGB color filter layers.

7.1.6.2 *resist pattern method* — color filter layers are accumulated on non-patterned ITO film by using a micell distribution liquid through openings (windows) in the photoresist according to the RGB pattern.

7.1.7 *multi-layer interference CF (Dichroic CF)* — multiple layers of inorganic transparent thin films are patterned by photolithography method.

7.1.8 *ink jet method* — color filter layers are formed by pigment or dye-colored ink blown out from an ink jet head nozzle onto the substrate pixels.

7.1.9 *others* — fabrication methods other than those above.

7.2 *coloring materials* — other than the multi-layer interference method, these are formed using pigments or dyes.

7.2.1 *pigment* — this can be pigment in fine powder form dispersed into plastic, or it can be pigment in fine powder form then encapsulated in micell (microcell) and dispersed in a water solution.

7.2.2 *dye* — patterned plastic or gelatin is colored using dye. Also, dyed plastic or gelatin can be patterned using photolithography.

7.2.3 *inorganic permeable thin film* — a clear thin film of inorganic material formed through methods such as vacuum deposition or sputtering.