

SEMI D46-0706

Terminology for FPD Polarizing Films

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1 Purpose

1.1 In this standard, definition and interpretation of each term provides material characteristics used for Flat Panel Display (FPD) manufacturing. This standard benefits unification of terminologies generally used for Polarizing Films of FPD manufacturing.

2 Scope

2.1 This standard is applicable for Polarizing Films of FPD manufacturing. It covers terminologies related to Polarizing Films of FPD manufacturing, used in the area of material, inspection, and measurement.

NOTICE: This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 The intention of this standard is providing terminologies for Polarizing Films of FPD manufacturing only. Hence, it does not cover any specific terminology used in a peculiar area (e.g., specialized terms based on personal subjectivity) or minor materials and details of those materials either for special and general purpose.

4 Referenced Standards and Documents

4.1 None.

5 Terminology

5.1 Definitions and Interpretations

- 5.1.1 Types of polarizer (1–5) (see Table 1)
- 5.1.2 Films and layers composing polarizing films (1–14) (see Table 2)
- 5.1.3 Type of polarizing (1–3) (see Table 3)
- 5.1.4 Characteristic (1–18) (see Table 4)
- 5.1.5 Inspection / Defect (1–8) (see Table 5)
- 5.1.6 Optical Factor (1–10) (see Table 6)

Table 1 Types of Polarizer

No	Term	Definition	Interpretation
1	Polarizer	Generic term of optical devices which are capable to generate polarized light from natural light.	PVA (Poly Vinyl Alcohol) is generally used for base films.
2	Absorbing Polarizer	Polarizer which generate polarized light using polarized two-color absorption. It mainly functions as linear polarizer.	Depending on the type of dicronic absorber, they include iodine type, dye type, etc. Polarizers made of PVA (Poly Vinyl Alcohol film) with iodine or dye impregnated are generally used.
3	Iodine type Polarizer	Polarizer using iodic complex as two-color absorber.	They are highly balanced in transmissivity, polarization degree, and achromatic property, and are currently mainstream of polarizers used for FPDs.
4	Dye type Polarizer	Polarizer using dye as two-color absorber.	As the dye itself has high durability, they are suitable for applications requiring

No	Term	Definition	Interpretation
			higher durability such as in-car products.
5	Reflecting Polarizer	Polarizer which generates polarized light using selective reflection. There are two types: linear polarization selectivity and circular polarization selectivity.	They include polarizers using circular dichroism of cholesteric liquid crystal and polarizers using mismatching between birefringence and refraction factors of layers. They also include polarizers using selective reflection of linear polarization on inclined incident multi-layer thin films, which are broadly used with absorbing polarizers for improving light utilization efficiency. Especially, the latter ones are abundantly used for projectors, etc.

Table 2 Films and Layers Composing Polarizing Films

No	Term	Definition	Interpretation
1	Retarder	Optical device which gives phase shift to polarized light depending on its optical axis.	They are generally called $\lambda/4$ films or $\lambda/2$ films, and are the generic name of optical devices which change polarizing conditions.
2	Retardation Film	Birefringent film.	As one with the polarizing film, makes possible black/white display and expands the viewing angle of the LCD panel.
3	Compensation Film	Name of the optical film used to improve the display characteristics of the LCD panel.	Depending on the LCD panel design, compensation film is selected and combined with the polarizing film.
4	Wide Viewing Angle Film	Film that widens LCD panel viewing angle.	Generally acts as a visual angle compensating layer in the film that forms the polarizing film.
5	Protective Layer ^{#1}	Film used to protect the polarizer.	TAC (Tri Acetyl Cellulose) is used the most as a base film.
6	Anti-Glare	Layer which reduce glare by forming scattering layer on the surface of protection layer.	Generally, particles such as silica are mixed in the UV hardening resin, forming unevenness on the surface.
7	Hard Coat	Resin coated on the surface of protection layer in order to prevent damage to the surface of the polarizing film.	Generally, there is AG (Anti-Glare abbreviation) hard coat and clear hard coat, and particles such as silica are mixed into AG hard coat.
8	Anti-Reflection	Layer which reduces the light reflection by processing multilayer thin films on the surface of protection layer.	In contrast to antiglare, which disperses light, anti-reflection has the function of decreasing reflected light.
9	Adhesive ^{#1}	Acts as an adhesion layer to attach the polarizing film to the LCD panel.	An adhesive that can be peeled off afterwards.
10	Separator	De-molded film adhered on adhesive layer of polarizing film, which is also called "Release Liner."	Generally, silicon-processed polyester film is used.
11	Reflector	Optical device which symmetrically reflects light on the normal line.	For the devices with high reflectivity, metal reflection or multi-layer reflection with dielectric materials is used.
12	Transflective Reflector	Optical device which transmits one part of light and reflects the other part.	Layer which transmits light from the rear side and reflects light from the front side. Effective for power saving by utilizing external light.

No	Term	Definition	Interpretation
13	Polarization Conversion Film	Film that utilizes polarized light, separation functionality to increase light, utilization efficiency.	Makes it possible to increase the brightness of the LCD as seen from directly in front and diagonally.
14	Retardation Film	Birefringent film.	As one with the polarizing film, makes possible black/white display and expands the viewing angle of the LCD panel.

#1 Basic Structure of Polarizer:

Protective Film
Protective Layer
Polarizer
Protective Layer
Adhesive
Separator

Table 3 Type of Polarizing Film

No	Term	Definition	Interpretation
1	Transmission-type Polarizing Film	Polarizer that uses transmitted light.	Used for LCD panels which display using a backlight (see Figure 1).
2	Reflection-type Polarizing Film	Polarizer that uses reflected light.	Used on the bottom of a reflection-type LCD panels that has a reflector adhered to the polarizing film. Reflector is used on the bottom surface of transmission-type polarizing film to reflect incident light (see Figure 1).
3	Transflection-type Polarizing Film	Polarizer with both transmission-type and reflection-type functions.	Polarizer with an attached transflector, it is used as a bottom-side polarizer on a transflection-type LCD panel. Transflector is used on the bottom surface of transmission-type polarizing film to utilize backlight and reflected incident light (see Figure 1).

Table 4 Characteristic

No	Term	Definition	Interpretation
1	Polarization Efficiency	(1) Value (P_y) calculated from the following formula using Parallel Transmittance ($T_{//}$) and Cross Transmittance ($T_{\perp}$). (2) Value calculated from the following formula using transmittance T_A (visibility corrected) on the absorption axis and transmittance T_B (visibility corrected) on the transmittance axis.	Refer to SEMI D34. 1) Measurement Method Measurement Equipment: Spectrophotometer Measurement Wavelength: 400~700nm (10 nm) Light Source: standard illuminant C, 2° range of view
2	Single Transmittance	Value (T_y) of Transmittance of 1 polarizing film, visibility corrected (JIS Z8701).	2) T_y , $T_{\perp}$, and $T_{//}$ can be calculated from the following formulas using the polarizer's transmittance T_A (visibility corrected) on the absorption axis and transmittance T_B (visibility corrected) on the transmittance axis.
3	Cross Transmittance	Value ($T_{\perp}$) of Transmittance of 2 polarizing films placed crossed Nicol, visually corrected (JIS Z 8701).	$T_y = (T_A + T_B)/2$
4	Parallel Transmittance	Value ($T_{//}$) of Transmittance of 2 polarizing films placed parallel Nicol, visibility corrected (JIS Z 8701).	$T_{\perp} = T_A \times T_B$ $T_{//} = (T_{A2} + T_{B2})/2$