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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 43793.3-2024

**Test methods of color photoresist for flat panel display - Part 3:
Reliability**

平板显示用彩色光刻胶测试方法 第3部分：可靠性

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1 Scope

The document describes the test methods for three indicators of the reliability of colour photoresist for flat panel display, namely chemical resistance, solvent shock resistance and dissolution performance in developer. Note: the reliability indicators of colour photoresist for flat panel display mainly comprise chemical resistance, solvent shock resistance and dissolution performance in developer.

It applies to the manufacture, the quality control and the research and development work on colour photoresist for flat panel display.

2 Normative references

The content of the documents listed below constitutes indispensable provisions of this document through normative reference in the text. For dated references, only the edition corresponding to that date applies; for undated references, the latest edition, including all amendments, applies.

GB/T 3979 Methods for the measurement of object colour; GB/T 5698 Colour terminology; GB/T 11186.3-1989 Methods for measuring the colour of paint films - Part 3: Calculation of colour difference; GB/T 18910.11 Liquid crystal display devices - Part 1-1: Terms and symbols; GB/T 43793.2 Test methods of color photoresist for flat panel display - Part 2: Optical properties; JJG 237-2010 Verification regulation of stopwatches.

3 Terms and definitions

The terms and definitions given in GB/T 5698, GB/T 3979 and GB/T 18910.11 apply to this document. The document adds no term of its own.

4 Environmental conditions

Unless otherwise specified, the test is carried out under the following conditions.

- a) Light is excluded throughout the test process; a filter film may be added to the light source of the test room to filter out ultraviolet light, stated in the document as below 500 nm.
- b) Ambient temperature: 23 °C +/- 2 °C.
- c) Relative humidity: 30 % to 70 %.

5 Chemical resistance

5.1 Principle: a colour filter of specified film thickness is prepared, immersed in a chemical reagent at a specified temperature and baked for a specified time; the chromaticity of the colour filter before and after the chemical treatment is measured and the colour difference is calculated, and this measures the chemical resistance of the colour photoresist.

5.2.1 Test container: a container of sufficient volume and depth to hold the specimen and the corresponding chemical reagent shall be used; it shall not be corroded by the chemical reagent used in the test and shall not abrade the surface of the specimen; a glass petri dish should be used.

5.2.2 Sample preparation equipment: includes but is not limited to the equipment that coats the colour photoresist on transparent glass and, through prebaking, exposure, development, postbaking and similar processes, prepares a colour filter with a specific uniform film thickness.

5.2.3 The microspectrophotometer is required as follows. a) Light source, wavelength range, wavelength interval and error: unless specially indicated, the light source is generally standard source C, with a halogen lamp or a cold cathode fluorescent lamp; the sampling wavelength range shall be 380 nm to 780 nm, the wavelength interval 1 nm or 5 nm and the error not greater than +/- 0.5 nm; the photometric repeatability shall be within 1 %. b) Calibration: the instrument shall be calibrated according to the manufacturer's instructions and the characteristics of the test instrument observed during the calibration recorded, including linearity and wavelength shift; the calibration interval shall not exceed 2 years. c) Stability of the chromaticity and brightness test: with the sample at rest, 20 tests are made; the maximum error of the brightness shall not be greater than +/- 0.05 and the maximum error of the chromaticity not greater than +/- 0.000 5.

5.2.4 Stopwatch: it shall conform to the metrological requirements of JJG 237-2010, with a measuring range of 0 s to 999 s and a smallest scale division of 10 ms.

5.2.5 Constant temperature blast oven: the temperature fluctuation shall be not greater than +/- 2 °C.

5.2.6 Thermometer: measuring range 0 °C to 150 °C, scale division not greater than 1 °C.

5.3.1 Test conditions: the test conditions and the chemical reagents used shall reflect the actual production process conditions of the supplier and purchaser of the colour photoresist and may be agreed jointly between them. The chemical reagents and test conditions specified in Table 1 should be adopted. Table 1 has five columns, chemical reagent, immersion temperature in degrees Celsius, immersion time in minutes, baking temperature in degrees Celsius and baking time in minutes, and six rows. N-methylpyrrolidone (NMP): 25 +/- 2, 5, 240 +/- 2, 15. Gamma-butyrolactone: 25 +/- 2, 5, 240 +/- 2, 15. Isopropyl alcohol (IPA): 25 +/- 2, 5, 120 +/- 2, 2. Methyl 3-methoxypropionate (MMP): 25 +/- 2, 10, 230 +/- 2, 30. Diethylene glycol methyl ethyl ether (MEDG): 25 +/- 2, 10, 230 +/- 2, 30. Deionized water: 85 +/- 2, 10, 105 +/- 2, 7.

5.3.2 Sample pretreatment: the colour photoresist is coated on a clean glass substrate and, following the prebaking, exposure, development and postbaking procedures, a colour filter with a specific film thickness is made and cut to the size specified in the operating instructions of the instrument.

5.4 Test procedure, carried out in the following order. a) The selected chemical reagent is placed in the test container and its temperature adjusted to the value specified beforehand. b) The specimen, thin film side up, is placed in the test container so that it is completely immersed in the chemical reagent; the container shall be covered in order to reduce evaporation of the solvent. c) The specimen is kept immersed in the chemical reagent for the specified time. d) The specimen is taken out of the container and rinsed gently with deionized water so as to remove the chemical reagent left on it without damaging the pixels. e) The specimen is dried completely by baking or blowing, cooled to room temperature, and the chromaticity is tested. f) The chromaticity measurement of the specimen before and after the test is made according to GB/T 43793.2, and the measuring position before and after the test shall be the same.

5.5 Expression of results: according to Clause 3 of GB/T 11186.3-1989, the colour difference is calculated from the chromaticity of the specimen before and after the test; the chromaticity test result of the specimen is kept to 4 significant figures and the colour difference to 3 significant figures.

5.6 The test report shall include the source, name and batch number of the test sample; the number of the test method standard used, that is the number of this document; the test conditions, namely the film thickness of the sample, the size of the test spot, the name of the chemical reagent, the immersion temperature, the immersion time, the baking temperature and the baking time; the test date; and the test results obtained, namely the chromaticity values of each measuring position of the specimen before and after the test, the chromaticity variation and the colour difference. The conversion between the Yxy colour space and the Lab colour space is given in GB/T 11186.3-1989.

6 Solvent shock resistance

6.1 Principle: after the colour photoresist has been flushed with a large quantity of solvent, the pigment or the components become unstable because of the extreme dilution and settle, forming particles inside the system; by testing with a high magnification optical microscope the number of solid particles per millilitre of filtered solution whose particle size is larger than a specific pore size, a method is obtained for judging the solvent shock resistance of the colour photoresist.

6.2 Instruments and solvents used in the test. a) The container shall be a colourless transparent test container of sufficient size and depth to hold the specimen and the corresponding chemical reagent and shall not be corroded by the chemical reagent used in the test; a transparent glass sample bottle should be used. b) The solvent used to flush the delivery pipeline of the colour photoresist at the user of the colour photoresist; propylene glycol methyl ether acetate or cyclohexanone may be used.

6.3 Test procedure, carried out in the following order. a) 20 mL of solvent is added to a transparent container of suitable size, so that a certain liquid level height is ensured. b) 2 mL of colour photoresist filtered through a filter membrane, whose pore size should be 0.22 μm and which is called filter membrane A below, is added to the container; the container is sealed and shaken thoroughly. c) It is left to stand for 12 h. d) An organic phase nylon filter membrane of 50 mm diameter, whose pore size is 10 to 15 times that of membrane A and not greater than 4 μm , called filter membrane B below, is observed under an optical microscope at 50 times magnification; three fixed observation points are taken on membrane B and, in the reflection mode of the microscope, the areas of those three points shall show no particles. e) The solution is filtered through membrane B, which is then rinsed with 5 mL of clean solvent; membrane B is then placed under the optical microscope at 50 times magnification and the fields of the three fixed observation points are observed, recording the number of solid particles per millilitre of filtered solution whose particle size is larger than the pore size of membrane B.

6.4 The test report shall include the source, name and batch number of the test sample; the number of the test method standard used, that is the number of this document; the test conditions, namely the type of solvent, the pore sizes of filter membranes A and B and the volume of solution filtered; the test date; and the test result obtained, namely the number of solid particles per millilitre of filtered solution whose particle size is larger than the pore size of membrane B.

7 Dissolution performance in developer

7.1 Principle: the dissolution performance of colour photoresist in developer is the capacity of the colour photoresist, after prebaking treatment and with the solvent removed, to dissolve in the developer and to resist crystallizing out. The dissolution performance is