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

GB/T 31034-2024

Replacing GB/T 31034-2014

**Insulating back sheet for crystalline silicon photovoltaic (PV)
modules**

晶体硅太阳能电池组件用绝缘背板

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Main technical changes Main technical changes against GB/T 31034-2014

Besides structural and editorial changes, the foreword lists: the co-extruded product type and its performance requirements have been added (Clause 4 and Table 1); requirements for mass per unit area and its permitted deviation, long term heat resistance, comparative tracking index, distance through insulation, transmittance and reflectance have been added (Table 1); the maximum system voltage requirement is now split between DC 1000 V and DC 1500 V (Table 1); the ultraviolet ageing irradiation dose has been restated in terms of UV300, UV200 and UV120 kilowatt hours per square metre instead of the former 60, 45 and 30 kilowatt hours per square metre (Table 1, formerly Table 3 of the 2014 edition); in the thickness test the instruction to record the median and report the minimum has become an instruction to take the mean to the nearest micrometre (6.3); the rule giving priority to the electrolytic sensor method in the water vapour transmission rate test has been deleted (formerly 6.5.1); in the tensile strength and elongation at break test the tensile speed has been changed from 100 mm/min to 50 mm/min and the result is now the mean rather than the median (6.8); the results of the interlayer peel strength test for the laminated type, the back sheet to encapsulant and back sheet to silicone peel strength tests and the ultraviolet ageing test are now the mean rather than the median (6.9, 6.11, 6.12 and 6.26); specimen size and number have been added for the breakdown voltage and elongation at break tests within the damp heat ageing and ultraviolet ageing tests (6.25 and 6.26); and the content of the abrasion test referring to JTG E40-2007 and JTG E60-2008 has been deleted (formerly 6.23).

3 Terms and definitions

3.1 water vapour transmission rate, WVTR: the quantity of water vapour passing through

unit area of a specimen in unit time under stated conditions of temperature and humidity. A note gives the unit as grams per square metre per day.

3.2 distance through insulation, DTI: the thickness value needed for a thin layer of insulating material to act as reliable insulation.

4 Classification

4 The back sheet protects and supports the crystalline silicon photovoltaic module and has reliable electrical insulation, hydrolysis resistance and resistance to ultraviolet, electrical and thermal ageing. Coated and laminated back sheets are usually of three-layer construction. The outer protective layer - a fluorine film such as polyvinyl fluoride (PVF) or polyvinylidene fluoride (PVDF), a fluorine coating such as tetrafluoroethylene resin (PTFE) or chlorotrifluoroethylene resin (CTFE), or a weather-resistant polyester (PET) - resists attack from the environment; the middle layer is usually a polyester (PET) film with good electrical insulation; and the inner layer, a fluorine film or resin coating, an ethylene-vinyl acetate copolymer (PEVA) or a polyolefin (POE), bonds well to the encapsulant. In the co-extruded type both the outer and the inner layer are usually POE material, the outer POE giving the weather resistance and the inner POE bonding to PEVA and similar encapsulants.

4 By production process the back sheet is divided into: a) laminated, made by laminating resin and PVF or PVDF on both faces of a PET film, or laminating resin and a fluorine film on one face and PEVA, POE or another encapsulant film or resin coating on the other; b) coated, made by coating a fluorine paint such as PTFE or CTFE on both faces of a PET film, or on one face with PEVA, POE, another encapsulant film or another film material on the other, giving a performance close to that of the laminated type; and c) co-extruded, made by extruding polymer materials in a single pass with a suitable extrusion process and dedicated extrusion equipment, giving an integrated back sheet able to meet the performance needs of the module.

5 Requirements

5.1 The surface of the back sheet is to be flat and free of bubbles, foreign matter, wrinkles and delamination. Other defects, such as scratches, indentations and uneven colour, are to be avoided as far as possible.

5.2 The thickness deviation is plus or minus ten per cent of the nominal value.

5.3 The performance meets Table 1, the abrasion resistance requirement being agreed between supplier and purchaser.

5.3 Table 1 is set out with the item, the unit and three requirement columns, one for each of the laminated, coated and co-extruded types. In the extracted text the item column, the unit column and the requirement columns are separated from one another and the values

cannot be matched to their rows and product types with certainty, so the figures are not reproduced here. The properties the table fixes are: mass per unit area and its permitted deviation; heat shrinkage, longitudinal and transverse; long term heat resistance, expressed as a relative temperature index (RTI) and a temperature index (TI); water vapour transmission rate, by the electrolytic sensor method and by the infrared sensor method; tensile strength; elongation at break; interlayer peel strength; coating adhesion, expressed as a grade; back sheet to EVA peel strength at 180 degrees; back sheet to silicone peel strength at 180 degrees; breakdown voltage; volume resistivity; maximum system voltage, separately for DC 1000 V and DC 1500 V; comparative tracking index (CTI) in three grades; distance through insulation (DTI); transmittance, for transparent back sheets over the band 400 nm to 1100 nm; reflectance, over one band for black inner layers and another for white inner layers; salt spray resistance; acid resistance; alkali resistance; solvent resistance; boiling water resistance; damp heat ageing, with appearance, interlayer peel strength and coating adhesion; ultraviolet ageing, with appearance, breakdown voltage, elongation at break and the yellowness index change on the air face; thermal cycling; humidity freeze; and abrasion resistance. Three notes state that either of the two water vapour transmission rate methods may be used, that salt spray, acid and alkali resistance are requirements for back sheets used in special locations, and that abrasion resistance is a requirement for back sheets used in desert regions.

6 Test methods

6.1 Sampling is from one batch of back sheet, the outermost two layers or turns of the roll being discarded and a full-width piece about two metres long taken as the sample. Unless otherwise stated, specimens are conditioned for at least 24 h at a temperature of 23 degrees Celsius plus or minus 2 and a relative humidity of 50 per cent plus or minus 5, and all tests are run under the same conditions.

6.2 Appearance is assessed visually in natural light on a full-width specimen about one metre long taken across the web.

6.3 Thickness follows Clause 5 of GB/T 13542.2-2021. Three full-width specimens 100 mm long are taken across the web and nine points are measured on each, no two points less than 50 mm apart; on unslit specimens the points are 50 mm from the edge, and on slit specimens 2 mm from the edge. The result is the mean, to the nearest micrometre, with the standard deviation recorded.

6.4 Mass per unit area follows Clause 5 of GB/T 5591.2-2017. Specimens are cut with a paper knife or a dedicated cutter and the mass of a specimen of area not less than 100 square centimetres is determined to within 0.5 per cent; three specimens are tested and the result is the mean.

6.5 Heat shrinkage follows Clause 26 of GB/T 13542.2-2021. Specimens are hung in a constant temperature oven at 150 degrees Celsius plus or minus 2 for 30 min; two

specimens are tested and the longitudinal and transverse shrinkages are averaged separately.

6.6 Long term heat resistance follows GB/T 11026.1, the end point being a fall of the elongation at break to fifty per cent of its initial value.

6.7 Water vapour transmission rate is measured either by the electrolytic sensor method under GB/T 21529 or by the infrared sensor method under GB/T 26253, in both cases at a temperature of 38 degrees Celsius plus or minus 2 and a relative humidity of 90 per cent plus or minus 2, on three specimens, the result being the median with the maximum reported.

6.8 Tensile strength and elongation at break follow Clause 13 of GB/T 13542.2-2021. Specimens are 200 mm long and 15 mm wide plus or minus 1, five in each of the transverse and longitudinal directions, the width being measured to better than 0.1 mm. Two gauge marks at least 50 mm apart are made in the middle of the specimen and the load is applied at 50 mm/min until a single component of the specimen fails. The result is the mean of the five values in each direction.

6.9 Interlayer peel strength, for the laminated type, follows GB/T 2790. Specimens are 200 mm long and 15 mm wide plus or minus 1, five in each direction, the width measured to better than 0.1 mm, one layer of the laminate being torn open along the length. The 180 degree peel test is run at a peel speed of 100 mm/min, as in Figure 1. The result is the mean of the five values in each direction, with the standard deviation reported.

6.10 Coating adhesion, for the coated type, follows GB/T 9286. At least three specimens of 150 mm by 100 mm are cut at different places; for coatings of 60 micrometres and below the cut lattice is 1 mm by 1 mm, ten squares in each direction. The grading and the illustration are given in Table 2, grade 0 being described as completely smooth cut edges with not one square detached.

6.11 Back sheet to encapsulant peel strength follows GB/T 2790. Five strips are cut, 10 mm wide plus or minus 0.5 and 250 mm to 300 mm long, and pressed onto ground glass with a PEVA or POE encapsulant for solar cell modules, in the order back sheet, encapsulant, glass; the pressing conditions follow the module encapsulation process and the type of encapsulant. After cooling to room temperature the 180 degree peel test is run on a universal testing machine at a peel speed of 100 mm/min and the result is the mean.

6.12 Back sheet to silicone peel strength is measured on two pieces of back sheet 200 mm by 15 mm, the silicone being spread evenly on the outer face of one and covered by the outer face of the other with no gap left, the silicone layer being 3 mm to 5 mm thick. The assembly is dried for seven days at 20 degrees Celsius to 25 degrees Celsius and 50 per cent to 80 per cent humidity. The test follows method A of GB/T 8808-1988 on five specimens and the result is the mean.