TEST REPORT

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EUROLAB LABORATUVAR A.Ş.

EUROLAB® Inspection & Testing Laboratory

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Sample ID : **EVA Film Ön**

	TEST	METHOD	RESULT	
-	**Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization**	**ISO 11357-3**	**76^{0}C**	
-	**Plastics — Determination of water absorption**	**ISO 62**	**0.01 % /24 hour**	
-	**Standard Test Method for Peel or Stripping Strength of Adhesive Bonds**	**ASTM D903**	**130 N/cm**	
-	**Standard Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials**	**ASTM E424**	**Optical Transmittance**	**UV cutoff Wavelength**
			95%	**360nm**
-	**Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies**	**ASTM D149**	**27 KV/mm**	
-	**Standard Test Methods for DC Resistance or Conductance of Insulating Materials**	**ASTM D257**	**10^{16}Ω.cm**	
-	**Ethylene Vinyl Acetate Copolymer (EVA) film for encapsulant solar module**	**GB/T 29848**	**Crosslinking**	**UV Aging**
			88%	**2 IY**

NOTE: This test result replaces the conformity assessment, can be presented to official institutions, and used in products and brochures.

Seal

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ISO 62: Plastics- Determination of water absorption

Scope

This International Standard describes a procedure for determining the moisture absorption properties in the "through-the-thickness" direction of flat or curved-form solid plastics. This International Standard also describes procedures for determining the amount of water absorbed by plastic specimens of defined dimensions, when immersed in water or when subjected to humid air under controlled conditions. The "through-the-thickness" moisture diffusion coefficient can be determined for single-phase material by assuming Fickian diffusion behaviour with constant moisture absorption properties through the thickness of the test specimen. This model is valid for homogeneous materials and for reinforced polymer-matrix composites tested below their glass transition temperature. However, some two-phase matrices such as hardened epoxies may require a multi-phase absorption model which is not covered by this International Standard.

Pre-Conditioning

Temperature	50 ^{0}C
Time	24 hour
Humidity	50% RH

Procedure

Determination of amount of water absorbed after immersion in water at 23 °C

1.Dry all replicate test specimens in an oven maintained at (50 ± 2) °C for at least 24 h and allow them to cool to room temperature in the desiccator before weighing them to the nearest 0,1 mg. Repeat this process until the mass of the specimens is constant (mass m_1) to within ± 0,1 mg.

2. Then place the test specimens in a container filled with distilled water maintained at 23,0 °C ± 1,0 °C or ± 2,0 °C, depending on the relevant specification. In the absence of a specification, the tolerance shall be ± 1,0 °C.

3. After immersion for (24 ± 1) h, take the test specimens from the water and remove all surface water with a clean, dry cloth or with filter paper. Reweigh the test specimens to the nearest 0,1 mg within 1 min of removing them from the water (mass m_2).

4. The water content at saturation is measured by re-immersing the test specimens and reweighing them at given time intervals. A typical immersion time scale is 24 h, 48 h, 96 h, 192 h, etc. At each of these intervals (± 1 h), remove the test specimens from the water, remove all surface water and reweigh each test specimen to the nearest 0,1 mg within 1 min of removing them from the water (e.g. m_2/24 h).

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Test Result

mass m_1	mass m_2	Time	Percentage by mass of water absorbed
0.9926 g	0.9927 g	24 h	0.01 %
0.9926 g	0.9928 g	48h	0.02%
0.9926 g	0.9929 g	96h	0.03%
0.9926 g	0.9931 g	192h	0.05%

ASTM D903: Standard Test Method for Peel or Stripping Strength of Adhesive Bonds

Scope

This test method covers the determination of the comparative peel or stripping characteristics of adhesive bonds when tested on standard-sized specimens and under defined conditions of pretreatment, temperature, and testing machine speed.

Pre-Conditioning

Temperature	23 ± 1 ^{0}C
Time	7 days
Humidity	50% RH

Procedure

1.Precondition or prepare the surface of the area to be bonded in accordance with the recommendations of the manufacturer of the adhesive.

2.Bond the specimens in accordance with the procedure and recommendations as outlined by the manufacturer of the adhesive and leave it to the conditioning.

3.Conduct the test as soon as possible after removing the test specimens from the conditioning atmosphere and preferably under the same conditions.

4.Separate the free end of the 25-mm. wide flexible member by hand from the other member for a distance of about 25mm. Place the specimen in the testing machine by clamping the free end of the 203 mm long member in one grip, turning back the free end of the flexible member and clamping it in the other grip as shown in Fig. Attach the separated end of the specimen, with all separate parts except the one under test securely gripped, to the recording head by means of a clamp using care to adjust it symmetrically in order that the tension is distributed uniformly. Maintain the specimen during the test approximately in the plane of the clamps. This may be done either by attaching the minimum weight required to the free end of the specimen or by holding the specimen gainst an alignment plate attached to the stationary clamp. In either case, take into account the added weight in determining the load causing separation. Grip the 25 mm. wide flexible member symmetrically and firmly without twisting in the power-actuated clamp. Adjust the autographic mechanism and chart to zero and start the machine. Strip the separating member from the specimen approximately at an angle of 180° and

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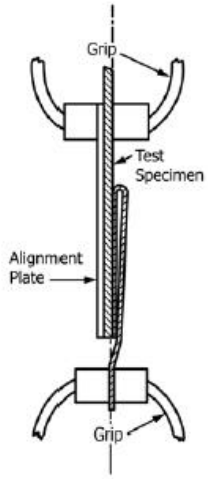
continue the separation for a sufficient distance to indicate the peel or stripping value. Peel at least one half of the bonded area, even though a peel or stripping value may be indicated before this point.



Test Result

Material	Test Result (N/cm)
Adhesion to Glass	130 N/cm

*EVA film was adhered to the glass sample for 8 minutes at 140 degrees.

ASTM E424: Standard Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials

Scope

These test methods cover the measurement of solar energy transmittance and reflectance (terrestrial) of materials in sheet form. Method A, using a spectrophotometer, is applicable for both transmittance and reflectance and is the referee method. Method B is applicable only for measurement of transmittance using a pyranometer in an enclosure and the sun as the energy source. Specimens for Method A are limited in size by the geometry of the spectrophotometer while Method B requires a specimen 0.61 m2 (2 ft2). For the materials studied by the drafting task group, both test methods give essentially equivalent results.

Method A—Spectrophotometric Method

Procedure

Measurements of spectral transmittance, or reflectance versus a magnesium oxide standard, are made using an integrating sphere spectrophotometer over the spectral range from 350 to 2500 nm. The illumination and viewing mode shall be normal-diffuse or diffuse-normal. The solar energy transmitted or reflected is obtained by integrating over a standard solar energy distribution curve using weighted or selected ordinates for the appropriate solar-energy distribution. The distribution at sea level, air mass 2, is used.

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Test Result

	Result
Optical Transmittance	95 %
UV Cutoff Wavelength	360 nm

ASTM D149: Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

Scope

This test method covers procedures for the determination of dielectric strength of solid insulating materials at commercial power frequencies, under specified conditions.

Unless otherwise specified, the tests shall be made at 60 Hz. However, this test method is suitable for use at any frequency from 25 to 800 Hz. At frequencies above 800 Hz, dielectric heating is a potential problem.

Procedure

1.Method A, Short-Time Test—Apply voltage uniformly to the test electrodes from zero at one of the rates until breakdown occurs. Use the short-time test unless otherwise specified.

2.When establishing a rate initially in order for it to be included in a new specification, select a rate that, for a given set of specimens, will give an average time to breakdown of between 10 and 20 s. In some cases it will be necessary to run one or two preliminary tests in order to determine the most suitable rate-of-rise. For many materials a rate of 500 V/s is used.

3.If the document referencing this test method specified a rate-of-rise, it shall be used consistently in spite of occasional average time to breakdown falling outside the range of 10 to 20 s. In this case, the times to failures shall be made a part of the report.

4. In running a series of tests comparing different material, the same rate-of-rise shall be used with preference given to a rate that allows the average time to be between 10 and 20 s. If the time to breakdown cannot be adhered to, the time shall be made a part of the report.

Test Result

Sample	Thickness	Dielectric Strenght
EVA Film Ön	0.59 mm	27 kV/ mm

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ASTM D257: Standard Test Methods for DC Resistance or Conductance of Insulating Materials

Scope

These test methods cover direct-current procedures for the measurement of dc insulation resistance, volume resistance, and surface resistance. From such measurements and the geometric dimensions of specimen and electrodes, both volume and surface resistivity of electrical insulating materials can be calculated, as well as the corresponding conductances and conductivities.

Conditioning

Condition 40/23/50 for specimens 7 mm (0.25 in.) or less in thickness, 88/23/50 for specimens over 7 mm. Condition in the standard laboratory atmosphere. Provide air circulation on all sides of the specimens by placing them in suitable racks, hanging them from metal clips, or laying them on wide-mesh wire-screen frames with at least 25 mm between the screen and the bench or other supporting surface.

40/23/50: Condition 40 h at 23 ^{o}C and 50% relative humidity.

Summary of Test Methods

The resistance or conductance of a material specimen or of a capacitor is determined from a measurement of current or of voltage drop under specified conditions. By using the appropriate electrode systems, surface and volume resistance or conductance are measured separately. The resistivity or conductivity is calculated with the known specimen and electrode dimensions are known.

Procedure

Volume Resistivity or Conductivity

Measure and record the dimensions of the electrodes and width of guard gap, g. Calculate the effective area of the electrode. Make the resistance measurement with a device having the required sensitivity and accuracy. Unless otherwise specified, use 60 s as the time of electrification, and 500 ± 5 V as the applied direct voltage.

Test Result

Test Conditions :

-Power supply: 500 V

-Time before measurements : 1 minute

-Atmospheric Conditions: 23 ^{0}C, 50% RH

Sample	Volume Resistance (Ω.cm)
Eva Film Ön	10^{16}

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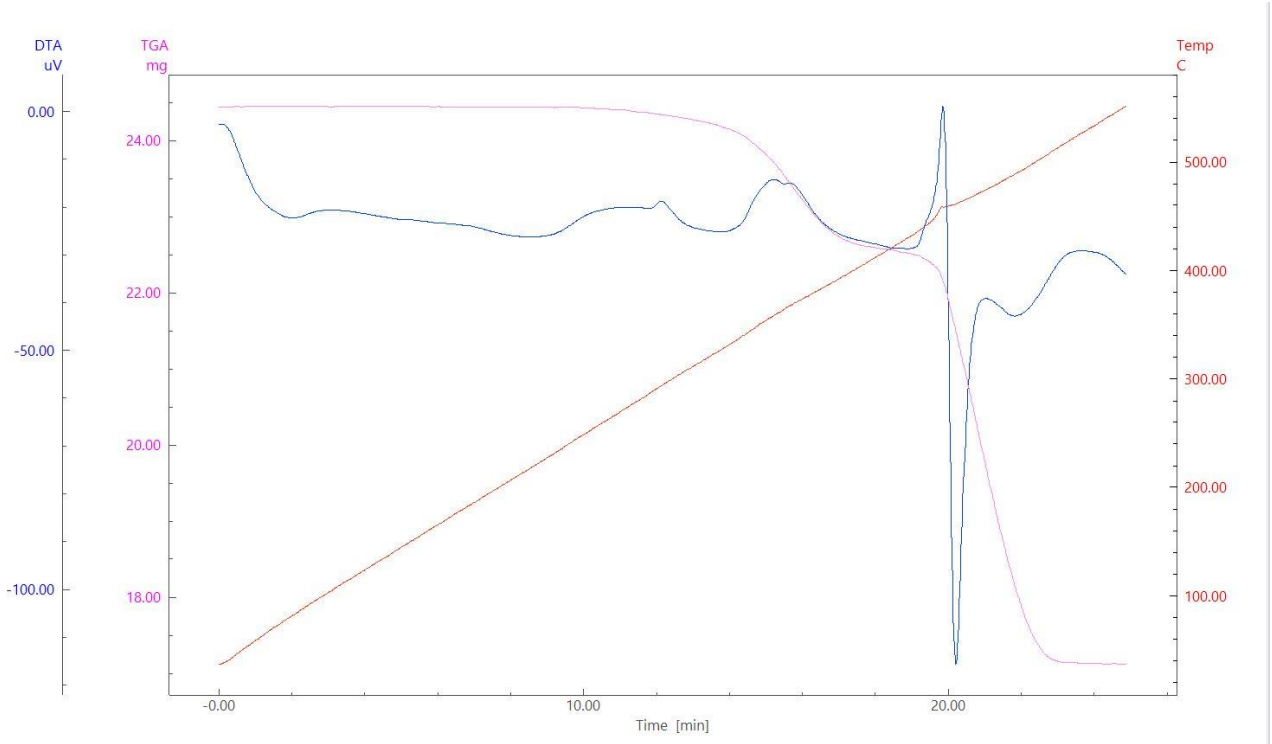
ISO 11357-3: Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization

Scope

This document specifies a method for the determination of the temperatures and enthalpies of melting and crystallization of crystalline or partially crystalline plastics.

Test Result



Sample	Melting Point
Eva Film Ön	76^0C

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GB/T 29848: Ethylene Vinyl Acetate Copolymer (EVA) film for encapsulant solar module

Scope

This standard specifies the terms and definitions, requirements, test methods, inspection rules, packaging, transportation and storage of ethylene-vinyl acetate copolymer (EVA) film for photovoltaic module encapsulation.

This standard applies to adhesive film using ethylene-vinyl acetate copolymer (EVA) as the main raw material, adding various additives and melt-processed for use in encapsulation of ground photovoltaic modules.

Determination of degree of cross-linking

Principle

The EVA film was cured by heating to form corss-linking, and the uncross-linked part of the sample was extracted with xylene solvent to measure the degree of cross-linking.

Procedure

1. Clean the stainless steel wire mesh bag, dry it, and weigh it as W_1 (accurate to 0,001g),

2. Take 0.5g±0.01g of the sample, put it into a stainless steel wire mesh bag, and make a sample package, which is called W_2 (accurate to 0,001g),

3. Seal the sample package with thin iron wire, mark it, insert it from the side port of the three-neck flask and seal it with a rubber stopper, add 1/2 volume of xylene solvent into the flask, and immerse the sample package in the solvent. Heating to about 140C, the solvent boiled and refluxed for 5h. The reflux speed is kept at 20 drops/min-40 drops/min,

4. After the reflux is completed, take out the sample package and hang to remove the solvent droplets. Then put it in a vacuum oven, the temperature is controlled at 140C, dry for 3 hours, and completely remove the solvent,

5.Take the sample package out of the oven, remove the iron wire, put it in a desicator to cool for 20 miutes, take it out, and weigh it as W_3 (accurate to 0,001g).

Test Result

Calculate the degree of cross-linking according to formula, and take the arithmetic mean value of the two groups of samples,.

In the formula;

$G=(W_3-W_1)/(W_2-W_1)*100\%$

G-degree pf cross-linking

W_1 is the weight of stainless steel wire mesh empty bag, in grams;

W_2 is the weight of the sample package, in grams;

W_3 is the weight of the sample package after solvent extraction and drying, in grams.

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W1 Value	W2 Value	W3 Value	Result
561 gram	561.52 gram	561.46 gram	88%

Sample	Result
EVA film Ön	88%

UV Accelerated Aging Test

Purpose

The ultraviolet accelerated aging test is used to test the light aging resistance of the cured EVA film exposed to the atmosphere.

Procedure

a) Allow the glass side of the specimen to face the light source, place it in the effective irradiation area of the UV-aging test chamber.Test conditions are as follows:

1) Ultraviolet spectral distribution: The irradiation intensity between the wavelengths of 280 nm and 400 nm is 50 W/m2 ~ 150 W/m2.The illumination uniformity at the surface of the test sample is within 15%. Irradiation in the 280 nm ~ 320 nm band accounts for 3% ~ 10% of the total irradiation;

2) While the ultraviolet irradiation is being performed, the surface temperature of the specimen in the test chamber is maintained at 60 °C ± 5 °C;

3) Accumulation of irradiation power: It is accumulated according to the actual exposure of the specimen's surface.

b) Test time: It is calculated based on the accumulated dosage of the radiation power, 120 kWh/m2.

c) After the test, remove the specimen. At an open environment of temperature 23 °C ± 5 °C and relative humidity of less than 75%, restore it for 2 h ~ 4 h.Check the appearance.There shall be free from appearance defects.The light-exposed surface of the white EVA is free from embrittlement or powdering.

d) Measure the YI yellowing index for the laminated sample before and after testing, respectively.

For each specimen, make measurement for at least 3 points.The yellowing index YI of the specimen is taken as the average of the measured points.Record the difference between the yellowing index YI after aging and the yellowing index YI before aging, which is the yellowing index ΔYI.

Test Result

Sample	Result (120 kWh/m2)
Eva Film Ön	2 IY

*****End of Report*****

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