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SAE J576 SEP86

Plastic Materials for Use in Optical Parts Such as Lenses and Reflectors of Motor Vehicle Lighting Devices

SAE Recommended Practice
Revised September 1986

Submitted for Recognition as an American National Standard

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HIGHWAY VEHICLE PRACTICE

Submitted for recognition as an American National Standard

SAE J576

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PLASTIC MATERIALS FOR USE IN OPTICAL PARTS SUCH AS LENSES AND REFLECTORS OF MOTOR VEHICLE LIGHTING DEVICES

1. SCOPE: This SAE Recommended Practice provides test methods and requirements to evaluate the suitability of plastic materials intended for optical applications in motor vehicles. The tests are intended to determine physical and optical characteristics of the material only. Performance expectations of finished assemblies, including plastic components, are to be based on tests for lighting devices, as specified in SAE Standards and Recommended Practices for motor vehicle lighting equipment. Field experience has shown that plastic materials meeting the requirements of this standard and molded in accordance with good molding practices will produce durable lighting devices.

2. DEFINITONS:

2.1 Material: The type and grade of plastics, composition, and manufacturer's designation (number) and color.

2.1.1 Coated Materials: A coated material is a material as defined in paragraph 2.1 which has a coating applied to the outer surface of the finished sample to impart some protective properties. Coating identification includes manufacturer's name, formulation designation (number) and recommendations for application.

2.2 Material Exposure:

2.2.1 Exposed: Material used in lenses or optical devices exposed to direct sunlight as installed on the vehicle.

2.2.2 Shaded: Material used in lenses or optical devices exposed to direct on sunlight only at angles less than 45 deg above the horizontal as installed the vehicle, but exposed to other environmental and service factors.

2.2.3 Protected: Material used in inner lenses for optical devices where such lenses are protected from exposure to the sun by an outer lens made of material meeting the requirements for exposed plastics.

2.3 Weathering Effects:

2.3.1 Color Bleeding: The diffusion of color out of plastic part into the surrounding surface of the part.

2.3.2 Crazing: Apparent fine cracks at or under the surface of a plastic part.

2.3.3 Cracking: A separation of adjacent sections of a plastic material with penetration into the specimen.

2.3.4 Haze: The cloudy or turbid appearance of an otherwise transparent specimen caused by light scattered from within the specimen or from its surface.

2.3.5 Delamination: A separation of the layers of a material including coatings.

3. TEST PROCEDURES:

3.1 Materials To Be Tested: Outdoor exposure tests shall be made on each material (as defined in paragraphs 2.1 and 2.1.1) offered for use in optical parts employed in motor vehicle lighting devices. Concentrations of polymer components and additives such as plasticizers, lubricants, colorants, weathering stabilizers, and anti-oxidants in plastic materials and/or coatings may be changed without outdoor exposure testing if: The changes are within the limits of composition represented by higher and lower concentrations of these polymer components and additives which have been tested in accordance with paragraph 3.3 and found to meet the requirements of Section 4.

3.2 Samples Required:

3.2.1 General: Samples of plastic preferably shall be injection molded into polished metal molds to produce test specimens with two flat and parallel faces. Alternative processing techniques may also be used to produce equivalent test specimens. Test specimen shape may vary, but each exposed surface should contain a minimum uninterrupted area of 32 cm^2 (5.0 in^2).

3.2.2 Thickness: A minimum of three samples shall be furnished covering the thickness range stated by the manufacturer. Recommended nominal thicknesses are: 1.6 mm (0.063 in); 3.2 mm (0.125 in); 6.4 mm (0.250 in). A 2.3 mm (0.090 in) sample is also suggested.

3.2.3 Number of Samples Required: Outdoor Exposure Test: 1 sample/each thickness/each site x 2 sites for each material = 2 samples/each thickness for each material. Control: 1 sample/each thickness for each material - 1 sample each.

NOTE: The control sample must be kept properly protected from influences which may change its appearance and properties.

3.3 Outdoor Exposure Tests:

3.3.1 Exposure Sites: Florida (warm, moist climate) and Arizona (warm, dry climate).

3.3.2 Sample Mounting: One sample of each thickness of each material at each test station shall be mounted so that the exposed upper surface of the samples is at an angle of 45 deg to the horizontal facing south. The exposed surface of the sample shall contain a minimum uninterrupted area of 32 cm^2 (5.0 in^2). The sample shall be mounted in the open no closer than 30 cm (11.8 in) to its background.

3.3.3 Exposure Time and Conditions: The time of exposure shall be as noted in paragraph 3.3.3.1 for each type of material exposed. During the exposure time the samples shall be cleaned once every three months by washing with mild soap or detergent and water, and then rinsing with distilled water. Rubbing shall be avoided.

3.3.3.1 Exposure Time Based On Material Usage: Exposed - (defined in paragraph 2.2.1): 3 yrs. Shaded - (defined in paragraph 2.2.2): 2 yrs. Protected - (defined in paragraph 2.2.3): 6 consecutive months starting in May.

3.3.3.2 Accelerated Weathering: After establishing and documenting correlation between accelerated and SAE outdoor exposure tests (paragraph 3.3) for the plastic material and colorant under consideration, accelerated weathering may be used to evaluate minor changes in concentrations of polymer components and additives (paragraph 3.1) previously found to be acceptable in the outdoor exposure tests. These tests may be used to establish acceptable high and low concentrations of the components and additives pending completion of three-year weathering tests. These tests will serve as an indication that the plastic materials are capable of meeting the performance requirements of Section 4.

The accelerated test shall be in accordance with ASTM D-4364, Standard Practice for Performing Accelerated Outdoor Weathering using concentrated natural sunlight utilizing night cycle water spray. The exposure of samples shall be 1000 megajoules/square meter of UV irradiance.

3.4 Optical Measurements:

3.4.1 Luminous Transmittance and Color Measurements: Measurements shall be made in accordance with ASTM E 308-66 (1973), Recommended Practices for Spectrophotometry and Description of Color in CIE 1931 System.

3.4.2 Haze Measurements: Measurements shall be made in accordance with ASTM D 1003-61 (1977), Test for Haze and Luminous Transmittance of Transparent Plastics.

4. MATERIAL PERFORMANCE REQUIREMENTS: A material in the range of thickness as stated by the material manufacturer, and defined in paragraphs 2.1 or 2.1.1, shall conform to the following requirements:

4.1 Before Exposure to Any Tests: The chromaticity coordinates shall conform with the requirements of SAE J578d (Sept. 1978) in the range of thickness stated by the material manufacturer.

4.2 After Outdoor Exposure:

4.2.1 Luminous Transmittance: The luminous transmittance of the exposed samples Ø using CIE Illuminant A (2856K) shall not have changed by more than 25% of the luminous transmittance of the unexposed control sample when tested in accordance with ASTM E308.

4.2.2 Chromaticity Coordinates: The chromaticity coordinates shall conform with the requirements of SAE J578d (Sept. 1978) in the range of thickness stated by the material manufacturer.

4.2.3 Haze: The haze of plastic materials used for lamp lenses shall not be greater than 30% as measured by ASTM D1003 (1977), Haze and Luminous Transmittance of Transparent Plastics. Plastic materials used for reflex reflectors and forward road illumination devices, excluding cornering lamps, shall show no deterioration.

4.2.4 Appearance: The exposed samples when compared with the unexposed controls shall not show physical changes affecting performance such as color bleeding, delamination, crazing, or cracking.

5. DETECTION OF COATINGS: In order to test for the presence of a coating, a Ø trace quantity (100 ppm max. in wet state) of an optical brightener should be added to a coating formulation. This should be checked by ultraviolet inspection against a known coated sample.

RATIONALE:

1. Section 1 Scope is being revised in two places making editorial changes only.

2. Par. 2.1 - Excess wording removed for simplification.

3. Par. 3.1 is being clarified on types of additives or components that may be changed. It also points out that the changes must be within limits already tested.

4. Par. 3.2.1 allows other means of making test specimens such as compression molding.

5. Par. 3.3.3.2 adds accelerated weathering as a technique to approve minor changes in components or additives in the interim pending completion of 3 year weathering tests. The correlation between outdoor and accelerated weathering on a material must be previously documented.

6. Par. 3.4.2 editorial corrections.

7. Delete Par. 3.5 - This paragraph deals with detection of coatings and should not be a part of Section 3 Test Procedures. It is therefore, placed at the end under a separate Sec. 5 guidelines for detection of coatings.

8. Par. 4.2.1 - Delete reference to a footnote. No longer needed.

9. Note (1) removed because it is a rationale statement. A 25% change in luminous transmittance of a lens will cause an approximate equivalent loss of device output (luminous intensity). It has been shown in visual comparisons during SAE lighting demonstrations that a luminous intensity change greater than 25% is required for 80% of the observers to detect a significant difference.

RELATIONSHIP OF SAE STANDARD TO ISO STANDARD:

Not applicable.

REFERENCE SECTION:

ASTM E 308-66 (1973), Recommended Practices for Spectrophotometry and Description of Color in CIE 1931 System

ASTM D1003-61 (1977), Test for Haze and Luminous Transmittance of Transparent Plastics

SAE J578d, Color Specification for Electric Signal Lighting Devices

APPLICATION:

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