Plastic Materials for Use in Optical Parts such as Lenses and Reflectors of Motor Vehicle Lighting Devices – SAE J576 JUN81

SAE Recommended Practice
Completely Revised June 1981

THIS IS A PREPRINT WHICH IS SUBJECT TO REVISIONS AND CORRECTIONS. THE FINAL VERSION WILL APPEAR IN THE 1982 EDITION OF THE SAE HANDBOOK.

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PREPRINT

φ PLASTIC MATERIALS FOR USE IN OPTICAL PARTS SUCH AS LENSES AND REFLECTORS OF MOTOR VEHICLE LIGHTING DEVICES—SAE J576 JUN81

SAE Recommended Practice

Report of the Lighting and Nonmetallic Materials Committee, approved January 1955, completely revised June 1981. Rationale statement available.

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 of this recommended practice are intended to determine physical and optical characteristics of the material only. Performance expectations of such a finished assembly, including its 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. Definitions

2.1 **Material**—For the purpose of this recommended practice the term "Material" includes type and grade of plastics, composition, and manufacturer's designation (number) and color.

2.1.1 Coated Material—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" includes manufacturer's name, formulation designation (number), and recommendations for application.

2.2 **Material Exposure**

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

2.2.2 Shaded—Materials used in lenses or optical devices exposed to direct sunlight only at angles less than 45 deg above the horizontal as installed on 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 a 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 section of a plastic material with penetration into the specimen.

2.3.4 Haze—The cloudy or turbid aspect or 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. A test of one color and formulation shall cover variations in dye concentration, but shall not cover changes in dye materials, polymers, or coatings.

3.2 **Samples Required**

3.2.1 General—Samples of plastic shall be injection molded into polished metal molds to produce test specimens with two faces flat and parallel. Test specimen geometry 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 years

Shaded—(defined in paragraph 2.2.2): 2 years

Protected—(defined in paragraph 2.2.3): 6 consecutive months starting in May

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 Measurement—Measurements shall be made in accordance with ASTM D 10003-61 (1977), Standard Method of Test for Haze and Luminous Transmittance of Transparent Plastics.

3.5 **Detection of Coatings**—*A trace quantity (100 ppm max in wet state) of an optical brightener shall have been added to a coating formulation in order to test for presence of the coating. This shall be checked by ultraviolet inspection against a known coated sample.*

4. Material Performance Requirements—A material in the range of thickness as stated by the material manufacturer, and as defined in paragraphs 2.1 or 2.1.1, shall conform to the following conditions:

4.1 **Before Exposure to Any Tests**—The chromaticity coordinates shall conform with the requirements of SAE J578d (September 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 using CIE Illuminant A (2856 K) shall not have changed by more than 25%[1] of the luminous transmittance of the unexposed control sample when tested in accordance with ASTM E 308.

4.2.2 Chromaticity Coordinate—The chromaticity coordinates shall conform with the requirements of SAE J578d (September 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% haze as measured by ASTM D 1003 (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.

The φ symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

[1] A 25% reduction in luminous transmittance is not discernable by the normal human eye.