Oregon
DEPARTMENT OF
Construction Section
800 Airport Road
Salem, OR 97301-4798
503/986-3059

Standard Guidelines for Product Review

Pavement Marking - Reflective Elements (Virgin) Section 00850

February 26, 2009

SCOPE

This specification describes reflective elements (glass spheres) for application on a variety of pavement marking materials to provide high retro-reflective qualities in both dry and wet weather. This is differentiated from reflective elements of a recycled nature, by its size and a tougher standard for clarity and performance. We require virgin reflective elements for use with traffic marking materials to comply with the following:

GENERAL REQUIREMENTS

The spheres shall be colorless, clean, transparent, free from milkiness or excessive airs bubbles, and essentially clean from surface scarring or scratching. The spheres shall be manufactured from virgin glass (not recycled). They shall be spherical in shape and at least 85 % shall be true spheres when visually inspected by sieve size.

SPECIFIC REQUIREMENTS

1. The refractive index of the spheres passing the #16 sieve and retained on the #18 sieve shall be a minimum of 1.530.

2. The silica content of the spheres shall not be less than 60%.

3. The percent of transmittance of the spheres passing the #16 sieve and retained on the #18 sieve shall be a minimum of 45% using amber oil.

4. The spheres shall have the following gradation when tested in accordance with ASTM D-1214:

SIEVE #	% RETAINED
12	0
14	0-5
16	0-15
18	30-70
20	20-50
30	5-25

5. The Type 1 spheres shall be coated with a silane type adherence coating to enhance its embedding in, and adherence to the applied binder film.

6. The glass spheres shall show no tendency to absorb moisture in storage and shall remain free of clusters and lumps and shall dispense readily under any conditions suitable for paint striping.

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CLARITY AND REFRACTIVE INDEX OF GLASS BEADS

SCOPE

This test method describes the measurement of the light transmission properties of glass bead specimens by the use of a spectrophotometer.

SIGNIFICANCE AND USE

Many glass bead specifications have minimum requirements for clarity and refractive index (RI). The Becke Line liquid immersion test for RI, can be subjective, lack precision, and requires a technician with great visual acuity. This method has the ability to generate RI values that are expressed to the 4th decimal place versus the Becke method's typical two decimal places.

The basis for these tests is that the transmittance of solid substances improves when the solid is in the presence of a liquid of identical RI. Two RI standard immersion oils can be mixed proportionally to obtain oils with secondary standard RI values between the two primary standards. Clarity can also be subjective and has often failed to be a property that can be stated specifically. This method measures quantifiably a beam of light's ability to pass through a glass bead sample.

The greater the RI, the greater the retroreflective brightness (ASTM F923 8.3.2.4). If beads are considered lenses, then the greater the clarity, the greater the retroreflectivity.

APPARATTI AND REAGENTS

Spectrophotometer, Hewlett Packard HP8452 Diode-Array UV-Visible, is capable of producing spectra in the visible light region (380-780 nm).

1 cm plastic cuvett holder

Supply of 1 cm plastic cuvetts with no visible light absorbance

Cargille RI immersion oil standards 1.500 and 1.5600 (4 ounces each)
%Transmittance >= 98%

RP Cargille Labs Inc.,
55 Commerce Rd.,
Cedar Grove, NJ, 07009-1289
Phone: (201)239-6633 Fax : (201)239-6096

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PROCEDURE FOR DETERMINING REFRACTIVE INDEX

1. A series of secondary standard oils with known indices is prepared by proportionally mixing the two primary standards volumetrically. For example a 50/50 mixture of standards with indices of 1.500 and 1.5600 would yield a secondary standard oil with a RI value of 1.53 (50%*1.500+50%*1.5600=1.5300). Secondary standards can be checked, by using a liquid refractometer.

2. Prepare sample by placing about 1mL of oil in a 1 cm cuvett. A few grams of screened glass bead sample are poured into the cuvett in such a way as to avoid occluding air bubbles.

3. Prepare and run a blank (A 1cm cell containing oil without beads)

4. Place prepared sample in the spectrophotometer and obtain a spectrum. Determine the wavelength of the transmittance maxima. If the maxima has a value less than 589.3nm, the glass beads have a RI less than the oil. And so conversely.

5. Prepare another sample using another secondary standard oil with a RI value that will yield a spectrum with a maxima at or closer to 589.3nm. A maxima that is about 100nm from 589.3 suggests that the glass bead sample is about 0.01 RI units different than the oil.

6. Two spectra, one with a maxima less and the other with a maxima greater than 589.3nm can be used to interpolate a RI value for the sample. A secondary oil standard can be prepared matching the interpolated value as a check.

DETERMINATION OF CLARITY

The value of the transmittance maxima at 589.3nm corresponds to clarity. Opaque impurities lower the %transmittance maxima.

SPECIFICATIONS

For glass beads passing a #16 screen and retained on a #18 screen the refractive index shall be greater than 1.530 and transmittance shall be greater than 45%.

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Process - Submit the following:

- Preliminary Information for Product Evaluation Form.
- Independent Test Results showing compliance with Specs listed above.
- Legible copy of the MSDS.
- Spec Data Sheet and brochure.
- Detailed installation instructions.
- List of Limitations and Precautions.
- Copy of your Quality Control Program
- Sample (approximately 2 quarts)

Submit documentation to:

MIKE DUNNING
OREGON DOT – MATERIALS LABORATORY
800 AIRPORT ROAD SE
SALEM OR 97301-4798
503-986-3059
http://www.oregon.gov/ODOT/HWY/CONSTRUCTION/QPL/QPIndex.shtml