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PhotoStress Coating Materials and Adhesives

FEATURES

- High strain-optic sensitivity
- Uniformity in optical and mechanical properties
- Wide variety for coating metals, plastics, concrete, elastomers, wood, composites, and other materials
- Detailed handling and application instructions



DESCRIPTION

Micro-Measurements manufactures the widest range of PhotoStress coating materials available. All of the materials are produced in an environmentally controlled "clean room" to ensure highest quality.

The selection charts on pages 3 and 4 are arranged to permit easy selection of materials for every application. The materials are grouped into:

1. High-modulus materials
2. Medium-modulus materials
3. Low-modulus materials

Sheet and liquid plastics for various applications are described on page 2. The adhesives listed on page 4 are recommended for use with these plastics and are similarly grouped to simplify selection and assure proper bonding of the sheet to the part under test.

Sheets for Coating Flat Parts

Pre-manufactured sheets are most economical for testing flat parts. The standard size for all sheet materials is 10 x 10 in (254 x 254 mm). For the PS-1 type, other standard sizes are 10 x 20 in and 20 x 20 in (254 x 508 mm and 508 x 508 mm, respectively). Thicknesses of sheets range from 0.010 to 0.120 in (0.25 to 3.05 mm). All sheets are calibrated for strain sensitivity, are held to very close dimensional tolerances, and are uniform in optical and mechanical properties from sheet to sheet. PS-1 sheets are provided with a reflective backing. All other sheets are clear. All sheets are supplied with a protective paper coating.

Liquids for Coating Complex-Shaped Parts

Liquid plastic materials are used for making coatings for structures with complex contours which cannot be coated satisfactorily with flat sheets. Surface forming, or "contouring", is the method of applying the plastic to the test part.

The liquid plastics are carefully controlled formulations of resins blended to provide (1) a coating of known photoelastic properties, (2) a controllable and repeatable curing schedule allowing ample time for contouring operations, and (3) repeatable optical and mechanical properties. Sufficient hardener is supplied for complete utilization of the resin.

Adhesive

Selection of the proper adhesive for use with the various photoelastic coatings is important. Micro-Measurements produces a wide variety to match the needs of the test conditions, and the properties of the coating materials to be bonded.

All adhesives listed are of the reflecting type. To obtain a clear adhesive with the same properties, add the letter "C" after the adhesive type (example: PC-1C).

REFERENCE LITERATURE

Tech Note TN-704, *How to Select Photoelastic Coatings*

Tech Note TN-701, *Calibration of Photoelastic Coatings*

Tech Note TN-706, *Corrections to Photoelastic Coating Fringe-Order Measurements*

Tech Note TN-702, *Introduction to Stress Analysis by the PhotoStress® Method*

Application Note B-221, *Instructions for Casting and Contouring Photoelastic Sheets*

Application Note B-223, *Instructions for Bonding Flat and Contoured Photoelastic Sheets to Test-Part Surfaces*

Application Note IB-238, *Calibration of Low-Modulus PhotoStress® Coatings by Imposed Curvature*

Application Note IB-239, *Instructions for Brushing PhotoStress® Coatings on Test-Part Surfaces*

Literature available on request from Micro-Measurements.

PhotoStress Coating Materials and Adhesives

FEATURES FOR HIGH-MODULUS COATING MATERIALS

PS-1 Sheet

- Excellent high-sensitivity plastic for accurate analysis in the elastic and elasto-plastic ranges of most metals
- Supplied with a processed reflective backing to increase bond strength of the material
- Very easy to machine
- Exhibits no time-edge effects
- Standard size sheets are 10 x 10 in, 10 x 20 in and 20 x 20 in (254 x 254 mm, 254 x 508 mm, and 508 x 508 mm, respectively)
- Tolerance on sheet sizes greater than 10 x 10 in (254 x 254 mm) is ±0.004 in (±0.10 mm)

PS-10 Sheet

- General-purpose clear plastic for analysis in elastic range of most metals
- Slightly lower sensitivity than for PS-1
- Excellent transparency
- Joins exceptionally well to itself, making it useful for making multi-sheet photoelastic models that require bonding

PL-1, PL-10 Liquid

- Room-temperature-curing plastics for casting contourable sheets to coat complex shaped surfaces
- PL-1 exhibits slightly higher sensitivity
- PL-10 is recommended for long-term testing (>30 days), since it will not darken with age
- Joins exceptionally well to itself, making it useful for making multi-sheet photoelastic models that require bonding

FEATURES FOR MEDIUM-MODULUS COATING MATERIALS

PS-3 Sheet

- Generally used for analysis of non-metallic materials
- Also used for post-yield investigations on metals

PL-2 Liquid

- A room-curing plastic for casting contourable sheets
- Uses are similar to type PS-3 sheet material

FEATURES FOR LOW-MODULUS COATING MATERIALS

PS-4 Sheet

- Used for analysis of parts made of high-elongation materials such as rubber

PL-3 Liquid

- Used for casting contourable sheets
- Similar to PL-2, but with higher elongation and lower modulus

PS-6 Sheet and PL-6 Liquid

- Used for application on extra high-elongation materials

PhotoStress Coating Materials and Adhesives

SPECIFICATIONS—COATING MATERIALS								
Model No.	Strain Optical Coefficient K	Elongation (%)	Elastic Modulus E 1000 psi (GPa)	Poisson's Ratio ν	Thickness		Sensitivity Constant to °F (°C)	Max Usable Temperature °F (°C)
					in (mm)	Tolerance		
HIGH-MODULUS								
PS-1 Sheet	0.150	5	360 (2.5)	0.38	0.120 (3.05) 0.080 (2.05) 0.040 (1.00) 0.020 (0.50) 0.010 [0.25]	±0.002 (±0.06)	300 (150)	300 (150)
PS-10 Sheet	0.090	3	450 (3.1)	0.36	0.120 (3.05) 0.080 (2.05) 0.040 (1.00) 0.020 (0.50)	±0.003 (±0.08)	160 (70)	400 (200)
PL-1 Liquid	0.100	3	420 (2.9)	0.36	For casting contourable sheets up to 0.125 in (3.2 mm)		180 (80)	450 (230)
PL-10 Liquid	0.080	3	420 (2.9)	0.36			160 (70)	400 (200)
MEDIUM-MODULUS								
PS-3 Sheet	0.020 (typical)	30	30 (0.21)	0.42	0.120 (3.05) 0.080 (2.05) 0.040 (1.00)	±0.003 (±0.08)	110 (40)	400 (200)
PL-2 Liquid	0.020 (typical)	30	30 (0.21)	0.42	For casting contourable sheets up to 0.125 in (3.2 mm)		110 (40)	400 (200)
LOW-MODULUS								
PS-4 Sheet	0.009 (typical)	>40	0.5 (0.004)	0.500	0.120 (3.05) 0.080 (2.05) 0.040 (1.00) 0.020 (0.50)	±0.003 (±0.08)	350 (175)	350 (175)
PL-3 Liquid	0.002 (typical)	>50	0.2 (0.0014) after 1 min. at constant strain	0.42	For casting contourable sheets up to 0.125 in (3.2 mm)		90 (32)	350 (175)
PS-6 Sheet	0.0006 (typical)	>100	0.1 (0.0007) after 1 min. at constant strain	0.500	0.120 (3.05) 0.080 (2.05) 0.040 (1.00)	±0.003 (±0.08)	90 (32)	300 (150)
PL-6 Liquid	0.0006 (typical)	>100	0.1 (0.0007) after 1 min. at constant strain	0.500	For casting contourable sheets up to 0.125 in (3.2 mm)		90 (32)	300 (150)

All physical and optical properties given are nominal values.

Other than PS-1, all sheets are standard size 10 x 10 in (254 x 254 mm). Standard packages for liquids are 3 oz (80 gm), 1 pt [0.47 litre), qt (0.950 litre), and gal (3.78 litre)

For all medium- and low-modulus materials, calibration is required for accurate strain optical coefficient values.

PhotoStress Coating Materials and Adhesives

FEATURES FOR HIGH-MODULUS ADHESIVES

PC-1C Adhesive

- For applications using reflective PS-1 sheets
- Excellent bond strength with absence of creep
- Relatively fast curing (12 hours at room temperature)
- Low viscosity enables very easy handling

PC-10 Adhesive

- For most applications using PS-1 and PS-10 sheets, and contoured sheets made from PL-1 and PL-10 liquids
- Same viscosity as PC-1C, except faster curing (3 to 4 hours at room temperature)
- Excellent bond strength with absence of creep
- Because its exothermic reaction is rapid, relatively small amounts should be mixed at one time

FEATURES FOR MEDIUM-MODULUS ADHESIVES

PC-6 Adhesive

- A room-temperature, 24-hour-curing adhesive for applications requiring a low-modulus adhesive
- Normally used for bonding PS-3 sheets, and coatings produced from PL-2 liquid plastic

FEATURES FOR LOW-MODULUS ADHESIVES

PC-9 Adhesive

- An extra-high-elongation material for use with PS-6 sheets, and contoured sheets made from PL-6 liquid plastic

PC-11 Adhesive

- A high-elongation material formulated for bonding contoured sheets prepared from PL-3 liquid plastic

PC-12 Adhesive

- A high-elongation adhesive for bonding PS-4 sheets to rubber

SPECIFICATIONS—ADHESIVES

Model No.	Cure Time (Hours)	Cure Temperature	Elongation (%)	Elastic Modulus E 1000 psi (GPa)	Max Usable Temperature °F (°C)	Standard Packaging*
HIGH-MODULUS						
PC-1C Adhesive	12	Room	3	450 (3.1)	180 (80)	3 oz, pt, qt
PC-10 Adhesive	3 to 4					3 oz, pt
MEDIUM-MODULUS						
PC-6 Adhesive	24	Room	50	30 (0.21)	400 (200)	3 oz, pt
LOW-MODULUS						
PC-9 Adhesive	24	Room	>100	0.1 (0.0007)	300 (150)	3 oz, pt
PC-11 Adhesive	24		>50	1 (0.007)	400 (200)	
PC-12 Adhesive	36		>50	1 (0.007)	350 (175)	

*Metric equivalents for 1 oz, 3 oz, pt, qt, and gal are 28 g, 80 g, 0.47 litre, 0.950 litre, and 3.78 litre, respectively.

All physical and optical properties given are nominal values.

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