

### PhotoStress Coating Materials and Adhesives



#### 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 3. 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.

#### 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

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 IB-221, Instructions for Casting and Contouring Photoelastic Sheets

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

Instruction Bulletin IB-238, Calibration of Low-Modulus PhotoStress® Coatings by Imposed Curvature

Instruction Bulletin IB-239, Instructions for Brushing PhotoStress® Coatings on Test-Part Surfaces

Literature available on request from Micro-Measurements.

### FEATURES FOR HIGH-MODULUS COATING MATERIAL

#### 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]
- Tolerance on sheet sizes greater than 10 x 10 in [254 x 254 mm] is  $\pm 0.004$  in [ $\pm 0.10$  mm]

#### PS-8 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-8 Liquid:

- Room-temperature-curing plastics for casting contourable sheets to coat complex shaped surfaces
- PL-1 Exhibits slightly higher sensitivity
- PL-8 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 MATERIAL

#### 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 MATERIAL

#### 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 & PL-6 Liquid:

- Used for application on extra high-elongation materials

SPECIFICATIONS - HIGH-MODULUS MATERIALS								
Model Number	Strain Optical Coef K	Elongation (%)	Elastic Modulus E 1000 psi [Gpa]	Poisson's Ratio $\nu$	Thickness		Sensitivity Constant to °F [ °C]	Max Usable Temperature °F [ °C]
					in[mm]	Tolerance		
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-8 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 PL-8 Liquid	(PL-1) 0.100 (PL-8) 0.080	3 3	420 [2.9] 420 [2.9]	0.36 0.36	For casting contourable sheets up to 0.125 in [3.2 mm]		180 [80] 160 [70]	450 [230] 400 [200]

SPECIFICATIONS - MEDIUM-MODULUS MATERIALS								
Model Number	Strain Optical Coef K	Elongation (%)	Elastic Modulus E 1000 psi [Gpa]	Poisson's Ratio $\nu$	Thickness		Sensitivity Constant to °F [ °C]	Max Usable Temperature °F [ °C]
					in[mm]	Tolerance		
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]

SPECIFICATIONS - LOW-MODULUS MATERIALS								
Model Number	Strain Optical Coef K	Elongation (%)	Elastic Modulus E 1000 psi [Gpa]	Poisson's Ratio $\nu$	Thickness		Sensitivity Constant to °F [ °C]	Max Usable Temperature °F [ °C]
					in[mm]	Tolerance		
PS-4 Sheet	0.009 (typical)	>40	.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]	300 [150]
PS-6 Sheet PL-6 Liquid	0.0006 (typical)	>100	0.1 [0.0007] After 1 min. at constant strain	.500	Sheet: Specify size. Liquid: For casting contourable sheets up to 0.125in [3.2 mm].		90 [32]	300 [150]

All physical and optical properties given are nominal values. NOTES (See below):

(1) 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].

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

### FEATURES FOR HIGH-MODULUS ADHESIVES

#### PC-1 Adhesive:

- For most applications using PS-1 and PS-8 sheets, and contoured sheets made from PL-1 and PL-8 liquids
- Excellent bond strength with absence of creep
- Relatively fast curing (12 hours at room temperature)
- Low viscosity enables very easy handling

#### PC-1T Adhesive:

- Same as PC-1 but with thixotropic agent added for bonding sheets to overhead or vertical surfaces
- Also used for edge-bonding sheets and for building fillets

#### PC-8 Adhesive:

- Formulated and recommended for bonding sheets in postyield studies where elongation exceeds 3%
- Combines high strength and modulus characteristics with high-elongation properties

#### PC-10 Adhesive:

- Same application as PC-1, except faster curing (3 to 4 hours at room temperature)
- 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 - HIGH-MODULUS ADHESIVES

Model Number	Cure Time (Hours)	Cure Temperature	Elongation (%)	Elastic Modulus E 1000 psi [Gpa]	Max Usable Temperature °F [°C]	Standard Packaging
PC-1 Adhesive	12	Room	3	450 [3.1]	180 [80]	1 oz, 3 oz, pt, qt
PC-1T Adhesive	24	Room	3	450 [3.1]	180 [80]	3 oz, pt, qt
PC-8 Adhesive	48	Room	5 (typical)	500 [3.5]	180 [80]	3 oz, pt*
PC-10 Adhesive	3 to 4	Room	3	450 [3.1]	180 [80]	3 oz, pt*

### SPECIFICATIONS - MEDIUM-MODULUS ADHESIVES

Model Number	Cure Time (Hours)	Cure Temperature	Elongation (%)	Elastic Modulus E 1000 psi [Gpa]	Max Usable Temperature °F [°C]	Standard Packaging
PC-6 Adhesive	24	Room	50	30 [0.21]	400 [200]	3 oz, pt

### SPECIFICATIONS - LOW-MODULUS ADHESIVES

Model Number	Cure Time (Hours)	Cure Temperature	Elongation (%)	Elastic Modulus E 1000 psi [Gpa]	Max Usable Temperature °F [°C]	Standard Packaging
PC-9 Adhesive	24	Room	>100	0.1 [0.0007]	300 [150]	3 oz, pt, qt
PC-11 Adhesive	24	Room	>50	1 [0.007]	400 [200]	3 oz, pt, qt
PC-12 Adhesive	36	Room	>50	1 [0.007]	350 [175]	3 oz, pt, qt

\*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.