



# ResinFormulators

INNOVATIVE MATTERS

## FULL-SERVICE LABORATORY AND TESTING SERVICES

Resin Formulators, the custom formulation division of GracoRoberts, is the time-tested and trusted brand of epoxy resins that can be uniquely customized, tested and certified on-demand.

The in-house chemical testing services performed by Resin Formulators' team of highly experienced chemists and technicians cover a wide-range of physical and mechanical techniques to ensure the quality and desired performance of your specialty chemical products. Our testing capabilities speed up the product development timeline by fifty percent, and increases our ability to test for customer specifications, batch requirements, and assist with expedite delivery needs.

We are pleased to offer the following advanced testing services which enable us to test a wide range of unique physical and mechanical properties to support your product engineering and quality control efforts. To discuss test method details or ASTM-specific options, please contact us at [info@resinformulators.com](mailto:info@resinformulators.com).



### LAB TESTING SERVICES

#### COMPRESSION STRENGTH | \$450

Compression Strength is the stress required to cause plastic deformation. Plastic deformation is the permanent change in the shape or size of a solid body without fracture, resulting from sustained stress beyond the elastic limit. Cylinder shaped specimens are placed in a test machine that applies an increasing compressive force until plastic deformation weakens the sample. The highest force recorded prior to deformation is the Compression Strength.

#### DEGREE OF CURE | \$450

The Degree of Cure is one of the key state variables in that it can describe the physical state of the thermoset as it transitions from a flowing resin into a solid matrix material. The degree of cure value can provide insight as to whether the polymer is still a flowing resin, has become a gelled semi-solid, or has become a physical solid with some insight into the potential mechanical strength of that solid.

#### DENSITY (SPECIFIC GRAVITY) | \$100

Density is mass divided by volume. We conduct these tests after conditioning the material to 75°F (24°C) to eliminate variation in density assessment due to temperature variation. Density will be provided in either pounds per gallon, or grams per cubic centimeter (also referred to as specific gravity).

#### DIFFERENTIAL SCANNING CALORIMETRY (DSC) | \$350

DSC is a thermal analysis apparatus measuring how physical properties of a sample change, along with temperature against time. In other words, the device is a thermal analysis instrument that determines the temperature and heat flow associated with material transitions as a function of time and temperature.

#### DYNAMIC MECHANICAL ANALYSIS (DMA) | \$450

A Dynamic Mechanical Analysis, otherwise known as DMA, is a technique where a small deformation is applied to a sample in a cyclic manner. This allows the materials' response to stress, temperature, frequency, and other values to be studied. It is extremely useful for defining engineering limitations for a materials' capacity to withstand specific temperature exposure.

## LAB TESTING SERVICES (CONT.)

### FOURIER TRANSFORM INFRARED SPECTROSCOPY (IR OR FTIR) | \$250

Fourier Transform Infrared Spectroscopy (FTIR) is a technique used to obtain infrared spectrum of absorption, emission, and photoconductivity of a solid, liquid, or gas. It is used to detect different functional groups in PHB. FTIR spectrum is recorded between 4000 and 400  $\text{cm}^{-1}$ . The resulting image is a chemical fingerprint of the material in question.

### GEL TIME | \$150

Gel Time is the time it takes for a mixed resin system to gel or become so highly viscous that it can no longer be considered workable or able to be handled. These tests are run using a 100-gram mass in our gel time test device.

### GLASS TRANSITION (TG) | \$350

Glass Transition Temperature (Tg) is a very useful property for understanding the thermal characteristics of an epoxy resin system. The Tg is the temperature at which the epoxy changes from a glassy (solid) state to a soft, rubbery state. It can be considered the point at which a measurable reduction in physical properties occurs resulting from exposure to elevated temperatures. Please note that Tg values can be reported after a second heat. The second heat is the process of testing the sample after it has been exposed to an initial first heat which results in an elevated temperature, 392°F (200°C), post-cured sample. The second scan test is useful to understand the outcome of a post cure exposure to the resin system, which, in many cases can boost the defined temperature resistance.

### HEAT CAPACITY | \$350

Heat capacity describes how much heat must be added to a substance to raise its temperature by 1 degree Celsius.

### HEAT OF REACTION/CURE KINETICS | \$350

This test method determines the exothermic heat of reaction of thermally reactive chemicals or chemical mixtures, using milligram specimen sizes, by differential scanning calorimetry. This test method is useful in determining the extrapolated onset temperature, the peak heat flow temperature and the heat of reaction of a material via ASTM E2160.

### LAP SHEAR (ASTM D1002) | \$350

Lap Shear measures the strength of an epoxy bonded joint when loaded in shear. The test is performed by bonding two metal coupons together with a 1/2" overlap and then pulling them apart with tension in a test machine. The tensile force creates a shear force in the bond line and the resulting stress is reported as the Lap Shear strength.

### MELTING POINT | \$350

Determining the melting point of a compound is one way to test if the substance is pure.

### MIXED VISCOSITY | \$250

Mixed Viscosity is the measurement of a materials resistance to flow for an A/B material system. Viscosity is taken at 75° F for the catalyzed resin system and is designed to assist with manufacturing process development.

### POT LIFE | \$200

Pot Life is the amount of time a mixture of resin and hardener has a workable viscosity while in the mixing container. Pot life is determined using 100-gram sample mass in a standardized container at 75° F. Both mass and ambient temperature affect the rate at which an epoxy system will cure. Pot life should be used only for comparative purposes when evaluating a resin system's cure time. Working Time is the amount of time the viscosity of the epoxy remains low enough to be processed. We can determine the effective pot life of a mixed resin system by measuring the starting viscosity of a material and identifying the point at which the viscosity has doubled.



## LAB TESTING SERVICES (CONT.)

### SHORE HARDNESS (OO, A, D) | \$100

Hardness is a measure of how hard the surface of a substance is. The harder the surface of a coating is, the more abrasion resistant it is. Testing is completed using a durometer which accurately measures the hardness of the surface of a cured resin.

### TENSILE STRENGTH | \$450

*(Customer-supplied coupons required)*

Tensile Strength is the stress that is required to fracture the epoxy and cause a failure. During this test, dog bone-shaped specimens are placed in a test machine that applies an increasing tensile force until failure. The highest stress recorded prior to failure is the Tensile Strength.

### T-PEEL STRENGTH | \$475

*(Customer-supplied coupons required)*

The primary purpose of this test method is to determine the relative peel resistance of adhesive bonds between flexible adherends by means of a T-type specimen. The term flexible refers to the ability of the adherend to bend through 90° without breaking or cracking.

### VISCOSITY: BROOKFIELD, ELEVATED TEMPERATURE ASSESSMENT | \$250

This test provides the materials' resistance to flow when tested at elevated temperature. The testing temperature ranges from 75° F to 400° F. Material resistance to flow will decrease as temperature increases. This test is designed to assist with manufacturing process development.

### VISCOSITY: BROOKFIELD, AMBIENT | \$200

This test measures the materials' resistance to flow. Testing is conducted after conditioning the sample to 75° F to standardize outcomes relevant to a set temperature as the material flow will change as a product is heated or cooled.

### VISCOSITY: PARALLEL PLATE | \$1,000

Viscosity testing using a parallel plate rheometer is determined when a small sample is placed between two oscillating parallel plates and then heated. During curing, the resin is converted from a liquid (not cross-linked) or semi-solid into a rigid cross-linked solid.

### WATER ABSORPTION | \$150

The Water Absorption test is used for the calculation of the relative water absorption rate by plastics during immersion in specified conditions.