BOND-CRP-01

COMPOSITE REINFORCED POLYMER

Reinforced composites are ideal materials for replacing metals in the construction of blades that spin to propel aircrafts or generate electricity.
Cured epoxy resins are ideal agents for bonding reinforcing fibers of all kinds, notably glass, graphite, and synthetics. The term “advanced” composites is sometimes used to distinguish composites in which reinforcing fibers are continuous instead of chopped. Cured epoxy resins are used as matrix resins for advanced composites in a variety of applications. A good example of an advanced composite application is pressure vessels, used as, for example, fuel tanks in natural gas-fueled vehicles. These are commonly fabricated by winding resin-soaked fibers around a cylindrical form, or mandrel. Light weight and good impact resistance are desirable features in this use.
Certain CRP-01 are ideally suited for use in composites. They are of low viscosity, resulting in good fiber wetting and minimum bubble retention, they cure slowly enough to allow sufficient working time, and epoxy resins cured with them bond exceptionally well to the fibers. De lamination a problem with reinforced composites−is thus minimized. Cured resin properties are generally suitable as well. The flexible polymer backbone gives elongation values of 10% or higher. Tensile strengths in the 8,000-10,000 psi range, and flexural modulus values of around 400,000 psi or higher are typical. These high elongations are associated with very good toughness and ductility, giving good damage tolerance and reducing the risk of catastrophic failure that might occur with more brittle systems. Cures with CRP-01 generally give lower T_g values than some other curing agents. For example, and a standard liquid bisphenol A resin, the T_g is around 90°C (195°F). If a higher T_g is required, other amines can be blended with the CRP-01 Part-B .

WHERE TO USE:-

An advanced composite application is pressure vessels, used as, for example, fuel tanks in natural gas-fueled vehicles. These are commonly fabricated by winding resin-soaked fibers around a cylindrical form, or mandrel. Light weight and good impact resistance are desirable features in this use. And for Boats, filament winding Tanks and piping, Wind Turbine Blades, etc.

METHOD OF USE:-

(1) SURFACE PREPARATION:- Surface should be Dry, clean, even and free from dust, dirt, paint, rust, Algee, grease, soluble salt, or other contaminations and Damp free. (2) Heat the substrate / item that should be treated (3) Mix equal volumes of Part A and Part B. The two parts must be thoroughly mixed together to obtain a properly cured coating. The pot life of this system is about 20 -30 minutes. Coatings of this type should be applied to horizontal surfaces. The object to be coated should be elevated from the work surface by a pedestal smaller in diameter than the object so the coating can flow freely off the edges. As soon as the coating is mixed, it should be apply over the object and, if necessary, spread with a brush to ensure complete coverage. The bubbles created during mixing are typically broken by brushing the coating’s surface or by blowing on it using forced hot air. Note that clear coatings of this type should not be used on objects exposed to direct sunlight. General-purpose epoxy resins will yellow over time under such conditions.

Mix the polymer in proper ratio and remove bubbles by applying heat (40 oC) for some time and vacuum the bubbled Air. (4) Apply the mixed polymer clear / colored (Add small drop quantity for light color and add more drop quantity for dark color in to the clear polymer. (5) Stoving should be done in closed oven for hard and glossy look. (6) Maintain temperature 40-60 oC for better results.
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Properties of cured ⅛-inch castings[1] (1 Cured 2 hr, 80oC; 3 hr, 125oC.)

BOND	**CRP-01**				
TYPE	EPOXY BASE				
Color	Clear Glossy				
Mixing 100 parts with Epoxy Resin 9000-1000 cps; EEW 176-183	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Type 5**
Part-B-1	45	33	16		
Part-B-2				32	25
Part-B-3		7	16		5
Viscosity (~25°C), cps (= MPa.s)	1,570	1,090	1,190	320	620
Surface-dry hr	5.5				
MIXING	Two pack				
Pot Life at R.T.	20-30 minutes after mixing				
METHOD OF USE	By Spray, pouring, spatula, roller, etc				
Through-dry	7.7 hr				
Cure: 24 hr, ~25^{o}C 48 hr, ~25^{o}C 7 days, ~25^{o}C	116 155 241				
T_g, °C (DSC)	93	107	130	90	98
Flexural Strength, psi (MPa)	15,900 (110)	17,100 (118)	18,200 (125)	14,800 (102)	19,000 (131)
Flexural modulus, psi (GPa)	404,000	404,000	402,000	455,000	490,000

	(2.78)	(2.78)	(2.77)	(3.14)	(3.38)
Tensile strength, psi (MPa)	9,100 (62.7)	9,800 (67.6)	11,000 (75.8)	9,700 (66.9)	10,700 (73.8)
Izod impact strength, ft-lb/in (cm-kg/cm)	0.90 (4.90)	0.58 (3.16)	0.45 (2.45)	1.3 (7.08)	1.5 (8.17)
Elongation, %	12.0	11.5	10.0	10.0	8.0
CHEMICAL RESISTANCE	Good				
Chemical Floor Epoxy					
Acetic Acid (5%) HH					
Acetic Acid (10%) H					
Acetone H					
Acetyl Bromide H					
Aluminium Bromide HHH					
Aluminium Fluoride HHH					
Ammonium Bromide (5%) HH					
Baking Soda HHH					
Barium Hydroxide HHH					
Beer HHH					
Benzene H					
Boric Acid HHH					
n-Butanol HHH					
Butyl Acetate H					
Calcium Chloride HHH					
Calcium Hydroxide HHH					
Carbon Disulphide H					
Carbon Tetrachloride H					
Carbonates HHH					
Carbonic Acid HHH					
Castor Oil HHH					
Chlorides HHH					
Chlorinated Paraffin HHH					
Chloroform H					
Chromic Acid H					
Citric Acid HHH					
Coconut Oil HHH					
Cotton Seed Oil HHH					
Diesel Oil HHH					
Dilute Detergents HHH					
Ethanol HHH					
Ethyl Alcohol H					
Ethylene Glycol HHH					
Fats HHH					
Ferric Chloride HHH					
Fish Oil HHH					
Fluorides (except HF) HHH					
Formic Acid H					
Gasoline HHH					
Ground Nut Oil HHH					
Chemical Floor Epoxy					
Heptane HHH					
Household Ammonia HH					
Hydrobromic Acid HH					
Hydrochloric Acid (dil) HH					
Kerosene HHH					
Lactic Acid (3%) HH					
Lime Juice H					
Linseed Oil HHH					
Lubricating Oils HHH					
Methanol HH					
Milk HHH					
Nitrates HHH					
Nitric Acid (10%) H					
Oleic Acid HHH					
Palm Kernel Oil HHH					
Palm Oil HHH					
Paraffin Wax HHH					

Petroleum Products HHH Phenol H Phosphoric Acid (10%) HH Pine Oil HHH Polypropylene Glycol HHH Potassium Hydroxide HHH Proprietary Sterilising Agents HHH Silicates HHH Sodium Carbonate HHH Sodium Chloride HHH Sodium Hydroxide HH Sodium Hypochlorite Soln.* HHH Soya Bean Oil HHH Sugars HHH Sulphates HHH Sulphuric Acid (45%) H Sunflower Seed Oil HHH Tannic Acid HHH Tetrahydronapthalene HHH 1,1,1-Trichloroethane HHH Vegetable Oils HHH Water HHH White Spirit HHH * (15% available chlorine) * Splash contact only ** Contact for max. 24 hours before washing off					
STORAGE LIFE	6 Months				
PACKING LITERS	2, 10, 30, 50 Kg pack				

WIND TURBINE BLADES

Reinforced composites are ideal materials for replacing metals in the construction of blades that spin to propel aircrafts or generate electricity. Although the process for making such blades is complex, the epoxy matrix may be as simple or as complicated as the formulator may desire. Because of the unique properties of the this systems. products mentioned above, a simple two-component system may suffice. The simplest system would be:

PART-A	PART-B-2 (230)
100	32

Such wind-powered electrical generators have been made with blade diameters ranging from a few feet to more than 250 feet. Top-coated with a tough urethane finish, large-diameter composite blades have turned generators continuously for years, while aluminum blades have succumbed to stress after only a few months of service.

FILAMENT-WOUND TANKS AND PIPING

The following formulation has been suggested for the manufacture of filament-wound objects, such as tanks.

PART-A Low-viscosity resin, 4,000-6,000 cps, EEW 172-176.	PART-B-1 (T-403)
100	46

For advanced fiber composites, a mismatch of thermal coefficient of expansion exists between the fiber and the matrix during a high-temperature-cure cycle, frequently resulting in de lamination or fiber “micro buckling." Moderate-temperature cure is therefore desirable.

The system presented above has mechanical properties that are well-balanced for filament winding – tensile and flexural strength and modulus are good, and elongation and impact strength are higher than those seen with many other epoxy formulations. With low viscosity and a moderate pot life, it presents no processing

problems in filament winding. The big advantage of this technique over metal for tanks and piping is no corrosion.
A unique composite application for the above formulation has been reported to be in stainless steel fiber/ organic matrix composites for cryogenic use (Ref. 502). This system has the distinct advantage that its thermal expansion characteristics are quite close to those of copper.

BOATS
Quality boats-racing sailboats, kayaks, canoes-are ideal subjects for epoxy systems cured with PEA. Canoes, for example, have been made from this system.

PART-A Epoxy resin, EEW ~188 100	**PART-B-2 (230 + 399)**
100	33 + 10

The amount of the Accelerator can be adjusted to obtain the desired pot life. Of course, for longest pot life, no accelerator is used at all, and the system below may be useful for fabrication techniques such as vacuum bagging where longer working time is desirable.

PART-A 1 Medium-viscosity resin, 7,000-10,000 cps, EEW 177-188	**PART-B-1 (T-403)**
100	44

This simple system is of low viscosity and wets the fiber network well. Working time should be adequate to meet most demands. Cure time would be 16 hours at 60°C, or only 1 hour at 120°C. (Oven curing is common with composites.)

TECHNICAL SERVICES & Technical assistance
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