

## Epoxy Resin Formulation

Polymer Matrix Composites (PMCs) are finding increasing number of applications in both Defence and Civilian sectors because of their light weight, durability and aesthetic appearance. Among various PMC, epoxy matrix composites are more popular due to following reasons.

- a. Low cost of epoxy resin,
- b. Ease of processability,
- c. Ability to give component without any shrinkage.
- d. Compatibility with commercially available fibers like carbon/, Glass fiber etc.

Following two classes of PMCs are popular which uses epoxy as the matrix system:

- a. Carbon fiber reinforced epoxy composites (C-epoxy composites)
- b. Glass fiber reinforced epoxy composite (G-epoxy composites)

### Areas of Applications:

C-epoxy composites are widely used in various Defence and civilian applications, while G-epoxy composites are used mainly in civilian applications. Some of the applications are mentioned below.

#### Defence Applications:

Structural subsystems of air crafts (wings, fuselages, airframes), UAVs

Structural subsystems of missiles (Composite rocket motor casing)

Armours of tanks, light weight composite bridges

Civilian applications: Automobile, civilian aircrafts, Industrial structures, Windblades, Boat hulls.

#### Drawbacks of existing (regular) epoxy systems:

Most of the commercially available CRPFs and GFRPs are made with epoxy resin system having DGEBA (Diglycidyl ether of bisphenol -A) as resin and epoxy and G-epoxy composites are lower compared to the theoretically possible mechanical properties due to brittle nature of the epoxy resin system. Though there are some new formulations of toughened epoxy resin systems available commercially which can give better mechanical properties, they suffer from low glass transition temperature ( $T_g$ ) and also high cost. Moreover these toughened resin systems are available as prepregs which makes it not suitable for structures which are realized by wet layup and wet winding process.

#### Special features of the epoxy formulation of ASL:

ASL has developed a toughened epoxy formulation with following features.

- a. Approximately 20-30% improvement in the most of the mechanical properties for both C-epoxy and G-epoxy composites without compromise in  $T_g$ .
- b. This formulation Involves adding certain additives to DGEBA and DETDA at defined quantities which modifies the toughness and crosslink density of the epoxy systems. The epoxy modification process is without need of any machinery.

**Cost Implication:**

Overall cost of the epoxy resin systems with these additives will be approximately of the same cost or slightly lower cost as that regular epoxy (DGEBA; DETDA) system.