Epoxy resins refer to a family of molecules or oligomers containing more than one epoxide group (Oxirane). These products are solid or liquid with the consistency of honey and have the ability to react via the epoxy end-groups to generate three dimmensional networks providing the final material with rigidity, hardness and the inability to reflow.

The final products generally exhibit:

- Excellent electrical properties
- Good adhesion due to presence of polar groups
- Low shrinkage
- Good impact resistance
- Moisture resistance

This family of thermosets is used in many applications like composites, coatings, adhesives and encapsulating materials.

The chemical chosen to react with these epoxides is referred to as the *curing agent* (or *hardener*), and it typically has active hydrogen attached to nitrogen, oxygen, or sulfur.
The selection of the curing agent depends on many parameters and will determine, to a large extent, the performance of the final epoxy thermoset.

The most common epoxy resins are glycidyl ethers of alcohols or phenolics. Liquid epoxy resin is the diglycidyl ether of bisphenol A (DGEBA) and represents greater than 75% of the resin used in industrial applications.

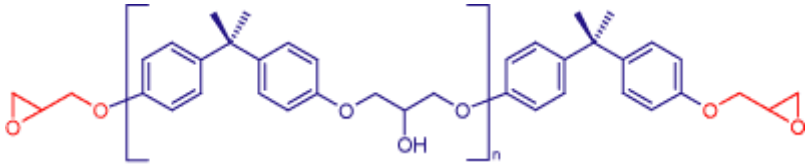

Figure 1: Structure of DGEBA resin

This resin has the consistency of honey. The epoxide group on the end of these molecules serves as the reactive site for crosslinking in these thermoset polymers. The chemical chosen to react with these epoxides is referred to as the curing agent, and it typically has active hydrogen attached to nitrogen, oxygen, or sulfur. Amine curing agents are the most common and can be primary or secondary, aliphatic or aromatic, or cycloaliphatic. The amines typically have greater than three reactive sites per molecule that facilitate the formation of a three-dimensional polymer network when mixed with the epoxy resin (figure 2).

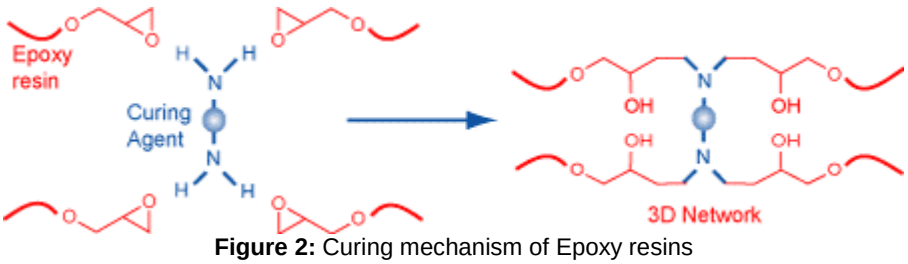

Figure 2: Curing mechanism of Epoxy resins

While the reaction of amines and epoxides occurs at room temperature and below, care must be taken in the selection of the curing agent to insure that a complete reaction takes place. Amines designed for room temperature applications typically employ plasticizers to insure complete reaction. Amines designed for heat-cured reactions use little or no plasticizers and typically give thermosets with higher strength and thermal performance.

The curing agent selection will determine, to a large extent, the performance of the final epoxy thermoset.