CHARPTER III

LITERATURE REVIEWS

Hatsuo Ishida* and Douglas J. Allen, [14]. A new class of phenolic-like thermosetting resins has been developed that is based on the ring opening polymerization of a benzoxazine precursor. These new materials overcome many of the traditional shortcomings associated with conventional novolac and resole-type phenolic resins, while demonstrating excellent physical and mechanical characteristics. The benzoxazines are copolymerized with an epoxy resin in order to modify their performance. The addition of epoxy to the polybenzoxazine network greatly increases the crosslink density of the thermosetting matrix and strongly influences its mechanical properties. Copolymerization leads to significant increases in the glass transition temperature, flexural stress, and flexural strain at break over those of the polybenzoxazine homopolymer, with only a minimal loss of stiffness. By understanding the structural changes induced by variations of epoxy content and their effect on material properties, the network can be tailored to specific performance requirements.

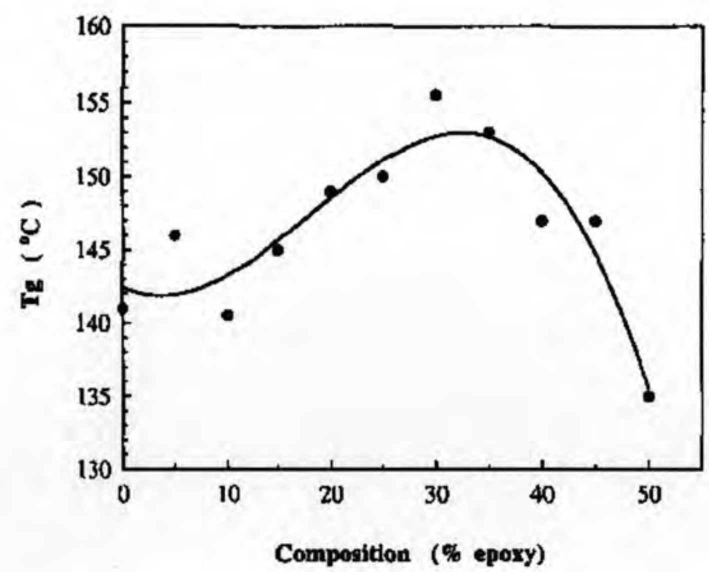

Figure 3.1: Variation of T_g of the benzoxazine-epoxy copolymers as a function of composition

H. Kimura, A. Matsumoto, K. Hasegawa, K.Ohtsuka, A. Fukuda, [15]. Bisphenol A based benzoxazine was prepared from bisphenol A, formaline, and aniline. This benzoxazine was used as a hardener of the epoxy resin. Curing behavior of the epoxy resin and the properties of the cured resin were investigated. Consequently, curing reaction proceeded without a curing accelerator. The molding compound showed good thermal stability under 150 °C, which corresponded to the temperature in the cylinder of injection molding. Above 150 °C, the curing reaction proceeded rapidly. The cured epoxy resin showed good heat resistance, water resistance, electrical insulation, and mechanical properties compared with the epoxy resin cured by the bisphenol A type novolac.

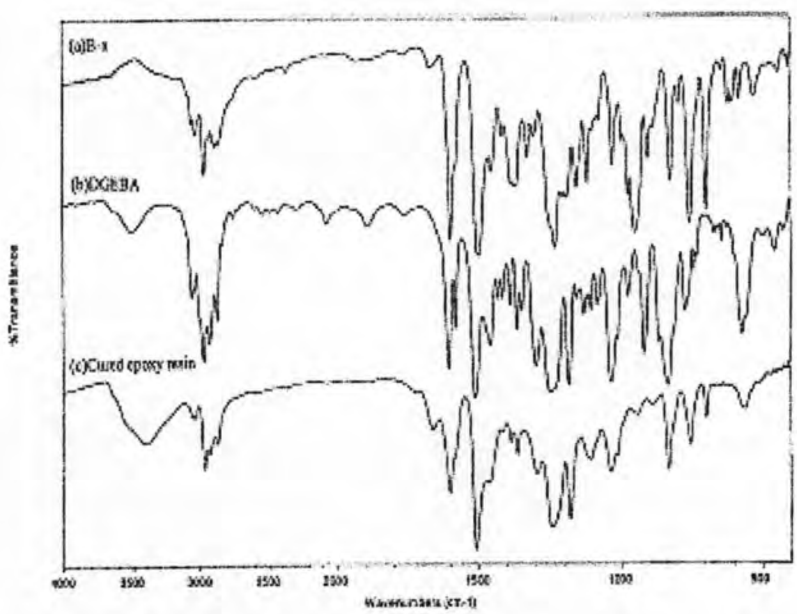

Figure 3.2 ; FTIR spectra of (a) B-a, (b) DGEBA, and (c) the cured epoxy resin.

BS Rao,. K Rajavardhana Reddy, Sandeep K Pathak and AR Pasala, 2005 [16]. Bisphenol-A-based benzoxazine was copolymerized with epoxy and chain-extended epoxies in order to study the effect of molecular weight on cured resin properties. Cure behaviour of the copolymers was studied using differential scanning calorimetry, which indicated a single exothermic curing peak at 248 °C. Dynamic mechanical thermal analysis was used to study the viscoelastic properties of the cured resins. A decrease in tan*D* peak position and an increase in storage modulus and tan*D* peak height were observed due to chain extension. Higher char yield was observed for the copolymer chain extended with tetrabromobisphenol-A.

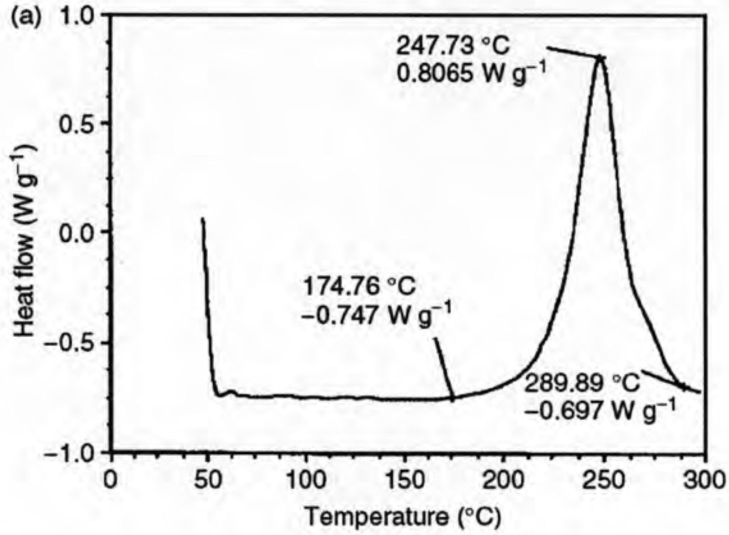

Figure 3.3 ; DSC thermogram of E-ba at a heating rate of 10 $^{\circ}$C min^{-1} in nitrogen.

A. Tontisakis, Y. Blyakhman, [5]. Huntsman advanced materials structural composite group is a leading supplier of matrix systems for advanced composites. Huntsman has been actively working in the development of high performance systems for Resin Transfer Molding (RTM) processes for aerospace and industrial composite applications. A new RTM system based on a novel benzoxazine/epoxy chemistry has been developed and is in the final phase of commercial introduction to the market place. This new system is processable at 177°C using traditional RTM techniques. The cured composite properties are superior to the traditional epoxy systems. The 177°C cured composite has glass transition (Tg) temperatures in excess of 200°C with excellent thermal mechanical properties. The cured neat resin modulus is significantly higher than the traditional epoxy systems and particularly; modulus retention under hot wet conditions is excellent.

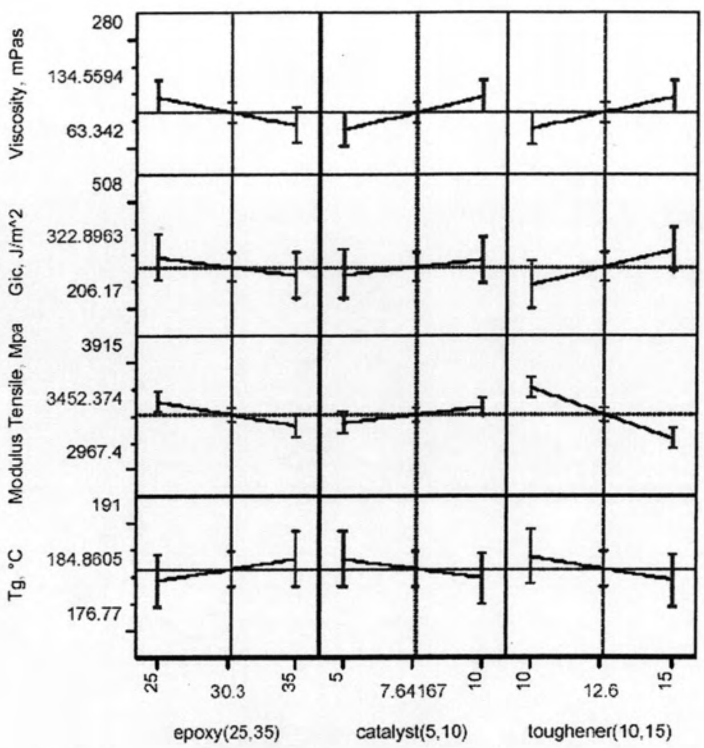

Figure 3.4 ; The effect of the responses by the three variables of epoxy (25.35), catalyst (5.10) and toughener (10.15).