Rheokinetic and Dynamic Mechanical Analysis of Tetrafunctional Epoxy/anhydride Mixtures. Influence of Stoichiometry and Cure Conditions

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Abstract: The copolymerization of hexahydrophthalic anhydride (HHPA) with $N,N,N',N'$-tetruglycidyl-4,4'-diaminodiphenylmethane (TGDDM) has been studied for several stoichiometric ratios. The rheological, thermal and dynamic mechanical behaviors of these systems were examined. Kinetic studies by differential scanning calorimetry, in both isothermal and dynamic modes, showed a first-order kinetics. Activation energies were also obtained by rheological measurements, through gelation times at different temperatures, with results in agreement with calorimetric results. The dynamic mechanical behavior was studied to analyze the influence of both stoichiometric ratio and cure schedule in the viscoelastic properties of the mixtures.

Key Words: Epoxy resin, anhydride, rheology, thermal, viscoelastic

1. INTRODUCTION

Epoxy resins are widely utilized as encapsulating materials, laminates, and adhesives in the electrical and electronic industries [1, 2]. The curing of epoxy resins with cyclic anhydrides is an important process for the fabrication of electrical insulating materials [3]. The properties of the cured epoxy prepolymer depend on their composition, the epoxy prepolymer structure, and the conditions of the curing process.

The full characterization of the cure process of an epoxy resin involves many factors. Phenomenological changes such as macroscopic gelation and vitrification take place