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Complex Cure Kinetics of the Tertiary Amine activated Reaction in DGEBA Epoxy Hardened with Diethanolamine[1] WINDY ANCIPINK, JOHN MCCOY, New Mexico Institute of Mining and Technology, Socorro, NM, CAITLYN CLARKSON, Purdue University, JAMIE KROPKA, MATHIAS CELINA, NICHOLAS GIRON, Sandia National Laboratories, Albuquerque, NM, LEBELO HAILESILASSIE, NARJES FREDJ, New Mexico Institute of Mining and Technology, Socorro, NM — The curing of a diglycidyl ether of bisphenol-A (DGEBA) epoxy with diethanolamine (DEA) involves a well understood fast amine-epoxide reaction followed by a more complicated slower hydroxyl-epoxide reaction. The time scale of these two reactions are well separated and can be studied independently from one another. The initial amine-epoxide reaction results in a tertiary amine adduct which is a product of the direct reaction of a secondary amine from the DEA reacting with a single DGEBA epoxide. The second hydroxyl-epoxide reaction results in a highly crosslinked glassy epoxy resin. The deviation in the mechanisms between high and low temperatures are discerned through the use of differential scanning calorimetry (DSC), infrared spectroscopy (IR), and isothermal microcalorimetry (IMC) data. Observations of reaction rates at temperatures ranging from 30C to 110C have led to the determination that the hydroxyl-epoxide reaction is temperature sensitive. The hydroxyl-epoxide reaction occurs through two different mechanisms: at low temperatures, the reaction is catalyzed by the tertiary amine adduct; at higher temperatures, the reaction does not appear to be catalyzed.

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