

*Cure Characterization of Thermosetting Polymers by
Rheology and Thermal Analysis:
Uncovering Unique Properties and Applications*

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Abstract

Thermosetting polymers are an important class of materials that have achieved widespread utilization in many high tech applications. The key advantage in the use of thermosetting polymers lies in the ability to start with a low viscosity liquid prior to curing. This allows the formulation of dispensable adhesives and coatings with tailored rheological properties. Additionally, partially curing or B-staging allows for unique processing of pre-applied coatings or composite structures using specially designed prepregs. The unique attributes of thermosetting polymers is driven by the curing mechanism which encompasses the chemical reactions that control both the chemorheology prior to gelation followed by development of a highly crosslinked network at full cure. An understanding of the time-temperature-conversion behavior, i.e. cure kinetics, provides the insights required to control the cure process. The single most important thermoset property is the degree of cure, which requires consistently high values to achieve the desired end-use physical properties. Typical highly cured thermosetting resins have high thermal resistance, high modulus, low moisture absorption, and high glass transition temperatures, T_g . The T_g plays a significant role in many ways. It provides a sensitive measure of degree of cure through the T_g -conversion relationship as well as imparting physical properties such as upper use temperature. The presentation will highlight the processing of thermosetting polymers from rheological properties, curing kinetics, T_g -conversion relationships, to development of the final cured properties. Specific nuances, such as how to achieve full cure in the glassy state by curing at very slow heating rates as a preferred means to maintain dimensional stability of the vitrified thermoset will be discussed.

Contact Jeff to discuss how he can help increase the impact of your next event by developing a tailored presentation to captivate your audience.

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