In-situ Frequency-Dependent Electromagnetic Sensing for Monitoring Physical and Chemical Attributes During Chemical Processing

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Abstract

The object of this research was to develop an *in-situ* sensing technique that monitors the molecular-level response of ions and dipoles to an applied electric field in order to characterize the changes in state of a polymer resin during chemical processing. This technique needs to be capable of monitoring the reaction process not only in the laboratory setting but also *in-situ* in the processing tool or reaction environment. Frequency Dependent Electromagnetic Sensing (FDEMS) was selected for this task.

This dissertation investigates the applicability of FDEMS to monitoring two types of processing methods: reactive and batch reactor. The reactive processing system examined involves the processing of a high glass transition thermoplastic, either polyethylene ether or polyether imide blended with a thermoset, diglycidyl ether of bisphenol-A and 4, 4'-methylene bis [3-chloro 2, 6-diethylaniline]. The batch reactor processing systems examined involve the *in-situ* process control of an industrial batch reactor process involving five different systems: epoxy acrylic, polyester, latex, emulsion for lotions and surfactants.