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On Line Monitoring of Cure Advancement and Gel Transition in Thermoset Processing by Multifunctional Fiber Optic Sensor

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The non isothermal polymerization of a commercial thermoset resin placed within an aluminum mold has been completely monitored by a unique optical fiber integrating both a refractometer and single Bragg grating. The fiber optic refractometer allowed to follow the evolution of the resin cure reaction by the measurement of the refractive index changes that are related to the density changes by the constitutive equation the Lorenz-Lorentz law. In addition, the fiber Bragg grating gave simultaneously information about the resin gelification onset by measuring the build-up of the process-induced strain during the whole cure cycle. The experimental results demonstrated the capability and the efficiency of the developed sensor system for the on-line monitoring of the main phenomena occurring during the consolidation of a thermoset based system.