Abstract

Gaf-chromic film is becoming a standard dosimetry media for the measurement of complex radiation fields. Gaf-chromic MD-55 film is composed of thin colorless polycrystalline substituted diacetylene monomer layers in a polyester base. When exposed to radiation the monomer undergoes a solid state polymerization event that renders a blue coloration of the film. The polymerization can also be initiated with ultraviolet, visible light, or heat. The spectra of irradiated gaf-chromic film exhibits two large absorption peaks at 675 nm and 610 nm. Optical density (OD) measurements taken at these wavelengths provides a sensitive form of dosimetry. Many dosimetry systems used for precise measurements utilize diode lasers (λ=670 nm) or HeNe lasers (λ=633 nm).

Using a custom built film scanning apparatus to provide accurate OD measurements, this project has investigated the red light induced polymerization of gaf-chromic film. Two laser sources were chosen to match the large absorption peaks of the MD-55 film (λ=671nm) and a HeNe laser (λ=633nm). A Macintosh computer running Labview™ was used to record the optical density and set the dwell time.

This project has measured a time variation of the polymerization kinetics resulting in an increased coloration rate as the OD measurement dwell time increases. The change in OD per unit time ranges from 2.0 OD/min. to 0.06 OD/min. This change in OD effects the slope of the calibration curve and dose measurements made with gaf-chromic film. The slope can change by as much as 10%. The non-linear OD changes with dwell time can introduce considerable uncertainties.