Humidity Dependence on the Dose Response of Dosimeter FWT-60 Film

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Objectives

1. Evaluate the humidity dependence of FWT-60 film over the humidity range 20-80%.
2. Compare this data at three different doses for trends in the value of the responses.
3. Determine if there are differences between Gamma irradiation and electron beam radiation on the response of the film in the selected humidity range.

Introduction

The use of FWT-60 radiochromic dosimeter film in different humidity environments can affect the response of the film to radiation. For this study the FWT-60 dosimeter film was subjected to various relative humidity levels between 20-80% to evaluate the response for both gamma and electron beam irradiation. Aluminum laminate pouches were used to create the consistent humidity environment for the dosimeter films. Three dose levels (10 kGy, 30 kGy and 50 kGy) were used to evaluate the response of the dosimeters for both types of irradiations. Two batches of dosimeter film (Batch 1106 and Batch 1097) were used to evaluate if any effects were batch related.

Results

The dose responses curve was fairly consistent and was within ±2% from 25-55%. Response at humidities above 55% showed reduced sensitivity. This trend was consistent for all three dose ranges tested and for both types of irradiations in both batches tested. A summary representation of the results for the study in terms of normalized dose response as a function of percent relative humidity is given in Figure 1.

Comparison of response at 10 kGy, 30 kGy and 50 kGy doses showed consistent uniformity within ±2% throughout the range of humidities studied with normalized relative to 50%. Figure 2 shows results for the gamma irradiations of Batch 1106 FWT-60 film dosimeters in terms of normalized dose response as a function of percent relative humidity.

The response of the film at each humidity level and dose were very similar for both gamma and electron beam irradiations in both batches. Figure 3 shows results for the averaged normalized responses from all three dose points of the gamma and electron beam irradiations of Batch 1106 FWT-60 film dosimeters as a function of percent relative humidity.

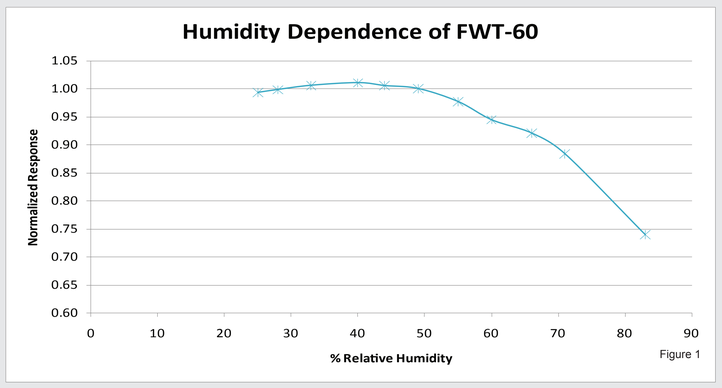

Figure 1

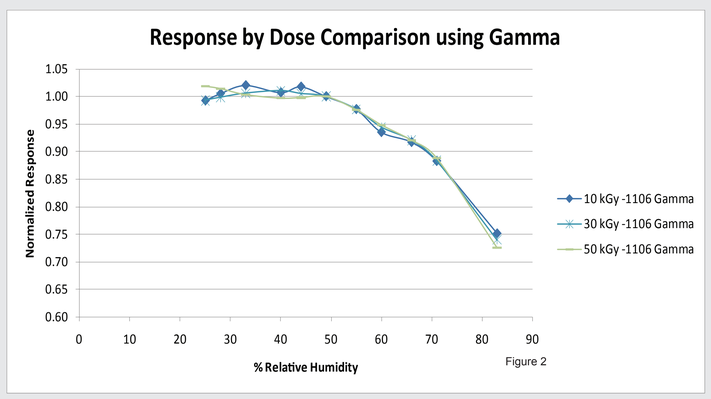

Figure 2

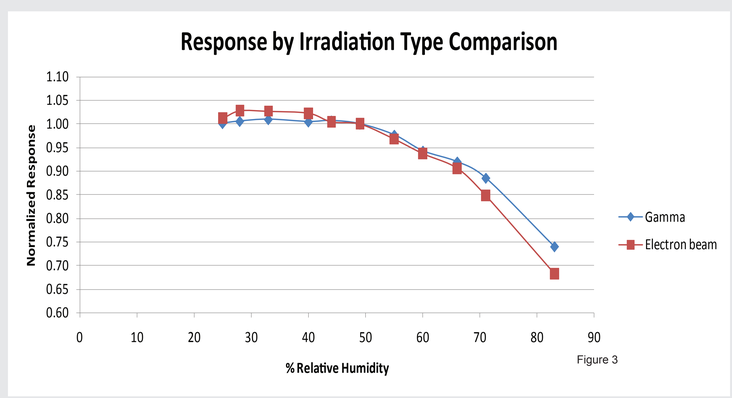

Figure 3

Conclusion

It is recommended to use the film in aluminum laminate pouches which provide a consistent humidity environment for the FWT-60 dosimeter film for use in measuring either gamma or electron beam irradiation. However, this is not always practical for all uses and thus understanding the response of the FWT-60 film to the irradiation environment can be critical for determining the correct dose received. If this is not possible, then the environment that the dosimeter film is subjected to should be monitored for amount of relative humidity and correction factor applied to the calculated dose. From the results of this study it was determined that as the relative humidity increases over 55% RH the response of the film to radiation decreases in both gamma and electron beam irradiation in the dose range studied. For environments below 25% relative humidity a study should be conducted by the user to determine an appropriate correction factor to apply to the dose calculation.