# GAFCHROMIC®

## DOSIMETRY MEDIA, TYPE HD-V2

WARNING: Store below 25ºC
Store away from radiation sources
Avoid exposure of film to sunlight
Handle film carefully, creasing may cause damage
Do not expose to temperatures above 50ºC

CONTENTS: 5 sheets, 8” x 10”

# GAFCHROMIC® HD-V2 Dosimetry Film

GAFCHROMIC® HD-V2 is a radiochromic dosimetry film designed for the quantitative measurement of absorbed dose of high-energy photons. As a self-developing film, HD-V2 is a perfect fit for the processorless environment. Since radiochromic film requires no post-exposure processing, there are no chemicals to dispose of and the film can be handled and used without need of a darkroom.

Key technical features of GAFCHROMIC® H-VD2 include:

- Dynamic Dose range: 10 Gy to 1000 Gy
- Develops in real time without post-exposure treatment;
- Energy-dependence: minimal response difference from 100keV into the MV range;
- Near tissue equivalent;
- High spatial resolution – can resolve features to at least 5μm;
- Can be handled in room light – eliminates the need for a darkroom;
- Active coating exposed for detection of low energy photon and electron

New Features

- Proprietary new technology incorporating a marker dye in active layer:
  - Enables non-unformity correction by using multichannel dosimetry
  - Decreases UV/light sensitivity;
- Better uniformity
- Stable at temperatures up to 60°C;

The most exciting new feature of GAFCHROMIC® HD-V2 over the previous generation of GAFCHROMIC® HD810 dosimetry film is the incorporation of a yellow marker dye. Used in conjunction with an rgb film scanner and FilmQAPro™ software, the marker dye in HD-V2 film enables all the benefits of multi-channel dosimetry. Using the marker dye feature is not mandatory. You can continue to perform dosimetry using only the red color channel, but you give up all the advantages of the multi-channel method that will make your film dosimetry better.

To learn more about FilmQAPro™ software and multi-channel film dosimetry, visit www.FilmQAPro.com.

The structure of GAFCHROMIC® HD-V2 film is shown in Figure 1. The film is comprised of a active layer, nominally 8μm thick, containing the active component, marker dye, stabilizers and other components giving the film its energy-independent response. The thickness of the active layer may vary slightly from batch-to-batch. The active layer is coated on a clear, 97 μm polyester substrate.

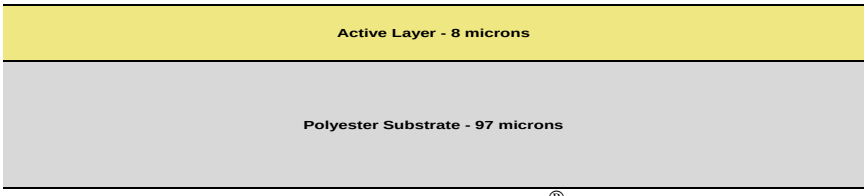


Figure 1: Configuration of GAFCHROMIC® HD-V2 Dosimetry Film

GAFCHROMIC® HD-V2 film has an asymmetrical cross section (see Figure 1). Measurements indicate that the response of scanner or densitometer may be dependent on which side of the film is facing the light source. It is advised that HD-V2 film be consistently measured with the same side of the film facing the light source regardless of whether landscape or portrait orientation is used.

To help in distinguishing between the sides, sheets of GAFCHROMIC® HD-V2 film are marked with a small slit near one corner. When film is viewed in a landscape orientation with the slit in the top right corner as shown in Figure 2, the unlaminated active layer is on the side facing the viewer.

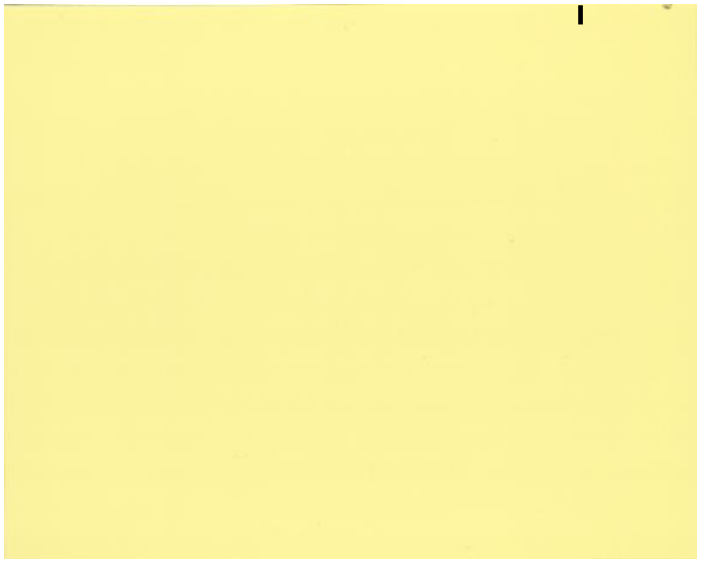

Figure 2: GAFCHROMIC® HD-V2 film in landscape view showing slit in top right corner.

**SPECIFICATIONS**

| Property | GAFCHROMIC® HD-V2 Film |
|---|---|
| Configuration | Active layer on 3.8 mil (97 μ) clear polyester substrate |
| Size | 8” x 10”, other sizes available upon request |
| Dynamic Dose Range | 10 to 1000 Gray |
| Energy dependency | <5% difference in net density when exposed at 1 MeV and 18 Mev |
| Dose fractionation response | <5% difference in net density$_2$ for a single 100 Gy dose and five cumulative 20 Gy doses at 30 min. intervals |
| Dose rate response | <5% difference in net density$_2$ for 10 Gy exposures at rates of 3.4 Gy/min. and 0.034 Gy/min. |
| Stability in light | <0.005 change in density per 1000 lux-day |
| Stability in dark (preexposure) | $<5x10^{-4}$ density change/day at 23 °C and $<2x10^{-4}$ density change/day refrigerated |
| Uniformity | Better than 3% in sensitometric response from mean |

## PERFORMANCE DATA AND PRATICAL USER GUIDELINES

When the active component in GAFCHROMIC® HD-V2 film is exposed to radiation, it reacts to form a blue colored polymer with absorption maxima at approximately 670 nm as shown in Figure 3.

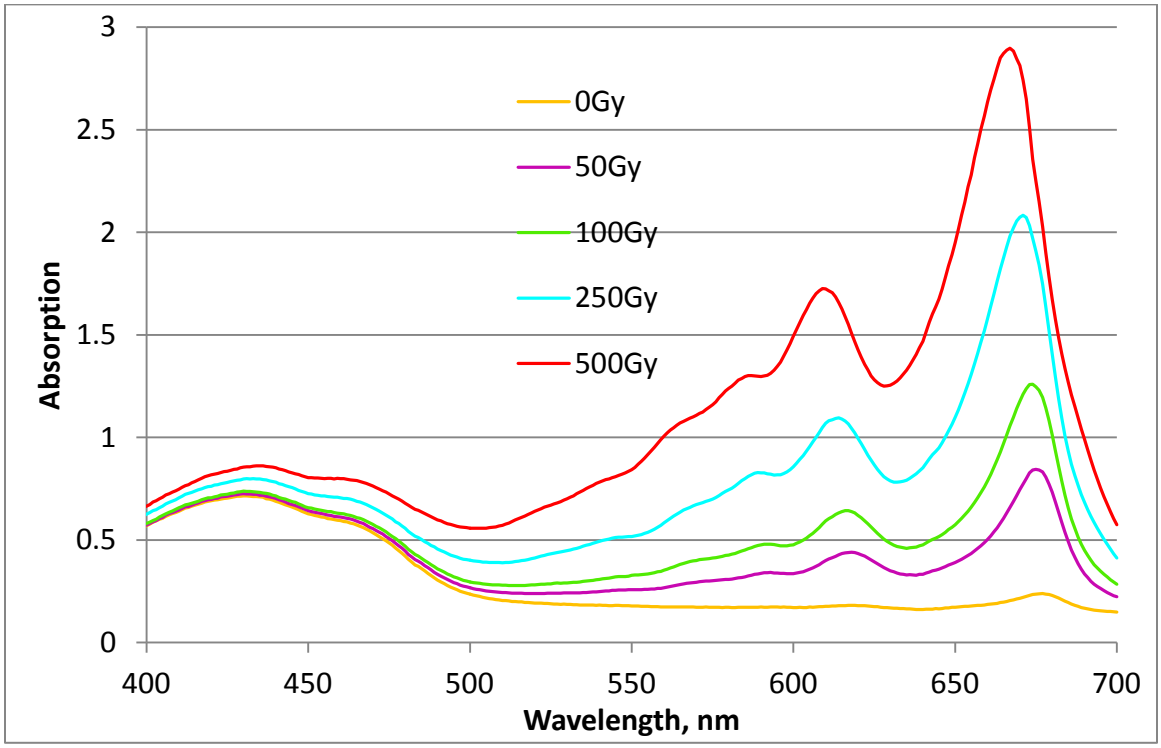


Figure 3 Spectra of GAFCHROMIC® HD-V2 as a function of adsorbed doses

GAFCHROMIC® HD-V2 radiochromic dosimetry film may be measured with transmission densitometers, film scanners or spectrophotometers. As one can infer from the Figure 3, the response of the dosimetry film media is enhanced by measurement with red light. In using a spectrophotometer the greatest response is obtained by scanning the film and using the peak absorbances. Most densitometers measure over a band of wavelengths and transmission densitometers for measuring colored films measure over various narrow color bands within the visible spectrum, e.g. visual, red, green and blue. Such densitometers are commonly and widely employed in the photographic industry.

To obtain two-dimensional information in speedy fashion, flatbed color scanners are shown to work well with all GAFCHROMIC® films including HD-V2 films. The commonly available professional photo scanners such as EPSON Expression 10000XL and 1680 flatbed color scanners can be used. These scanners are color scanners and measure the red, green and blue color components of the film in a color depth of 16 bit per channel.

A typical dose response of HD-V2 film on an rgb color scanner is shown in Figure 4. We recommend to fit the calibration curve in function form of

$$\bar{d}_X(D) = -\log\left(\frac{a+b\,D}{c+D}\right),$$

where $d_x(D)$ is the optical density of film in scanner channel x at dose D, and a, b, c are the equation parameters to be fitted. The advantages of these functions are:

- They are simple to invert and determine density as a function of dose, or dose as a function of density;
- They have rational behavior with respect to the physical reality that the density of the film should increase with increasing exposure yet asymptote towards a near constant value at high exposures – polynomial functions characteristically have no correspondence to physical reality outside the data range over which they are fitted;
- Since these functions have the described rational behavior, fewer calibration points are required saving time and film:
    - To cover a dose range of 0 – 1000 Gy requires 6-8 dose points, for example, 0, 25, 50, 100, 200, 400, 800 and 1200 Gy.

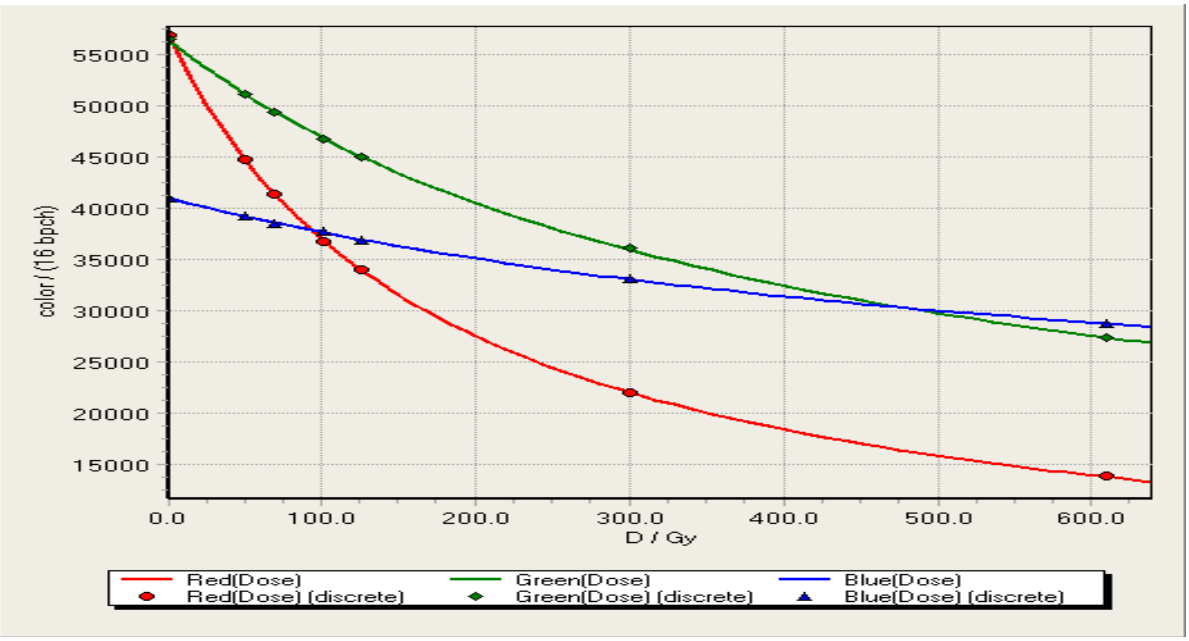


Figure 4: Response of GAFCHROMIC® HD-V2 in all Color Channels