

## Highlights

### Features Of All GAFCHROMIC® Radiochromic Dosimetry Films

- Self-developing radiation-sensitive films for dosimetry and QA measurements in radiation therapy
  - State-of-the-art radiochromic film technology
- Can be handled in room light.
- Eliminates need for darkroom
  - reduces space requirements
  - Cut and handle in room light, no light-tight cassettes,
  - Easy work flow
- Eliminates post-exposure processing and costs
  - No hazardous or corrosive chemicals, no waste disposal issues
- Products designed and optimized for both low energy and high energy photons
- Spot dose measurement, or 2-D and 3-D mapping of treatment fields
  - Ideal for IMRT
- Accurate and uniform
- Tissue equivalent
- Dose-rate independent
- No dose fractionation effects
- No orientation effects
- Water resistant - withstands brief immersion in water

### Features and Benefits of GAFCHROMIC® XR-RV2 Film

*Ideal training tool for interventional radiologist. The film helps to measure surface peak skin dose in interventional procedures guided by fluoroscopy*

- Coated on an opaque, white base with a yellow filter and viewed in reflection like a printed photograph
- 14" x 17" size radiochromic dosimetry film for measuring and mapping patient skin exposure during fluoroscopically guided procedures
- Self developing, no post exposure processing, no waste disposal issues
- Can be handled in room light, eliminates need for darkroom
- Assures facility compliance with 1994 FDA advisory on patient exposure measurement and documentation
- Removes the uncertainty of dose estimation
- Shows the maximum dose and its location
- Shows how the total dose was distributed

- Provides a quantitative record for patient files
- Provides physician with guidance to enable safe planning of future fluoroscopically guided procedures
- Improves fluoroscopic technique and patient safety
- Color and optical absorbance changes in proportion to absorbed dose
- Dynamic range 1Gy to 50Gy
- Outstanding uniformity
- Minimal energy dependency from about 30keV to 30MeV  
- Dose rate independent
- No dose fractionation effects
- Quantitative measurements with densitometer or scanner
- Rapid semi-quantitative evaluation with visual color comparison chart

## Configuration and specs

### GAFCHROMIC® XR-RV2 Radiochromic Dosimetry Films for Low and High Energy Photons

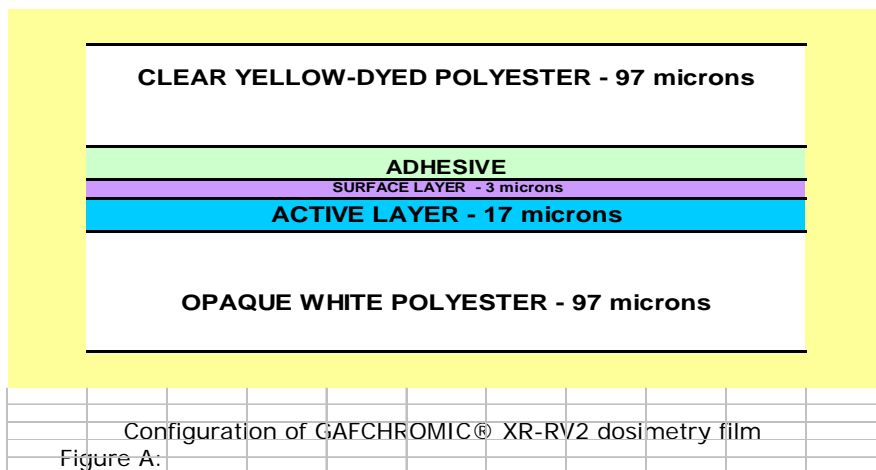
#### Configuration And Specifications

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#### Description

GAFCHROMIC® XR-RV2 radiochromic dosimetry films have been developed for both the measurement of absorbed dose of low energy and high energy photons. It is sensitive to photons with energies between 30KeV and 30MeV thus sensitive over a wider energy range than its predecessor XR-R. However our principle goal remained the same and that is to provide dosimetry film media that can be used to measure patient skin dose in interventional procedures guided by fluoroscopy. For this reason, the product has been designed to have minimal dependence on photon energy over a wide range

GAFCHROMIC® XR-RV2 radiochromic dosimetry film is a reflective film. Its structure is shown in Figures A



In this product the active layer is sandwiched between two sheets of polyester; one transparent film substrate and one opaque, white film substrate. The transparent polyester substrate used in the film contains a yellow dye. One purpose of the yellow dye is to enhance the visual contrast of the chromatic changes that occur when the film is exposed to radiation. A second purpose is to protect the active layer against exposure by UV and blue light and thereby enable the film to be even more tolerant of being handled in the light. The opacity of the white substrate in XR-RV2 is provided by a baryta filling. The polyester film substrates are 380 gauge, i.e. approximately 97 microns in thickness. It employs the same active component but includes a proprietary high Z material thus making it more sensitive than XR-R. The thickness of the active layer is about 17 microns and may vary from batch-to-batch in order to provide the products with reproducible sensitometric response. Details concerning particular batch numbers will be provided upon request.

Like GAFCHROMIC® XR-R, GAFCHROMIC® XR-RV2 too does not require an adhesive laminating film to bond the two coated polyester substrates as with MD-55. Through the use of proprietary ISP technology, the need for the adhesive laminate has been eliminated and the XR-RV2 media consist solely of the active layer sandwiched between the polyester substrates. This construction of the XR-RV2 films much like XR-R produces dosimetry media that are much more flexible than GAFCHROMIC® MD-55. Thus GAFCHROMIC® XR-RV2 dosimetry films can, with care, be bent to a radius as small as 5mm.

GAFCHROMIC® XR-RV2 radiochromic dosimetry films may be measured with densitometers, film scanners or spectrophotometers. When the active component in the films is exposed to radiation, it reacts to form a blue colored polymer with absorption maxima at about 635nm. Therefore, the response of GAFCHROMIC® XR-RV2 dosimetry media is enhanced by measurement with red light. Reflection densitometers (e.g. X-Rite 310 and Gretag-Macbeth D-19C) are available to measure in various parts of the spectrum (e.g. visual, red, green and blue) and are commonly and widely employed in the photographic and printing industries.

Economical (<\$1000) flatbed color scanners with 48 bit resolution or 16bits/channel works best with GAFCHROMIC films. With such scanners it is best to work in reflection mode. These scanners measure the red, green and blue color components, and by using the data from the red color channel and green color channel, the sensitometric response curve from 1Gy to 50Gy can be obtained for XR-RV2.

Frequently, scanning systems and densitometers developed for conventional silver halide medical x-ray film employ a white light source. The yellow polyester base in GAFCHROMIC® XR-RV2 films absorbs blue light, enhancing, to a degree, the sensitometric response of the media.

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### Specifications Of GAFCHROMIC® XR Radiochromic Dosimetry Films

The following table lists typical performance data, based on evaluation of prototype batches of GAFCHROMIC® XR-RV2. It is ISP's intention to produce subsequent batches of film to meet these performance standards. However, since these are new products with limited history we do not warranty that future batches will meet this level of performance in all respects. The performance characteristics of individual batches of film will be available upon request.

| Property                    | GAFCHROMIC® XR-RV2 Film  |
|-----------------------------|--|
| Configuration               | Active layer between polyester substrates  |
| Size                        | 14" x 17"; other sizes upon request  |
| Substrate 1                 | 380 gauge transparent yellow polyester   |
| Substrate 2                 | 380 gauge opaque white polyester   |
| Active layer thicknesses    | ~17microns <sup>1</sup>  |
| Sensitometric response      | Net density of 0.39, 0.75, 1.27 and 1.54 at absorbed doses of 0.75Gy, 2Gy, 6Gy and 10Gy respectively         |
| Energy dependency           | <8% difference in net density for 5Gy exposures between 80keV - 120keV                                       |
| Dose fractionation response | <1% difference in net density between a single 5Gy dose and four cumulative 1.25Gy doses at 30min. intervals |
| Dose rate                   | <3% difference in net density between exposures at   |

|                                  |  |
|----------------------------------|--|
| Stability in light               | <0.005 density change per 1000lux-day <sup>2,7</sup> |
| Stability in dark (pre-exposure) | <0.5x10 <sup>-3</sup> density change/day at 23°C     |
| Uniformity, cross web            | <5% <sup>8</sup>                                     |
| Uniformity, down web             | <3% <sup>9</sup>                                     |
| Sheet-to-sheet uniformity        | <5% sensitometric response difference from mean      |
| Batch-to-batch uniformity        | <15% sensitometric response difference from mean     |
| Post exposure                    | <10% from 1 hr to 1 day after exposure;              |

1. Actual thickness may vary slightly from batch-to-batch in order to match sensitivity specification.
2. 120kVp x-rays, 2mm aluminum filtration
3. Measured with X-Rite 310, cyan color channel. Net density is the change in density due to the absorbed radiation dose
4. Measured with Epson Expression 1680.
5. Cool white fluorescent light
6. 2σ.100/density - 34 measurements at 0.5" intervals
7. 2σ.100/density - 24 measurements at 0.5" intervals

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