B3 薄膜剂量计

技术和使用信息

B3薄膜剂量计产品是WINdose剂量测量系统的奠基石。 每一片剂量计都是在严格的质量标准下生产，以确保连贯性和稳定性。下面是一些用以成功使用该产品的一些技术细节和推荐。

使用:

应用：适用于由B3薄膜制造的所有产品，包括*B3 WINdose*和*B3 DoseStix*辐射变色薄膜产品。

波长和测量读出说明： 在整个使用范围内，B3剂量计以前都是使用554nm的波长测量。吸光度波长峰值最近更接近于552nm。 由于B3薄膜较宽的峰值，介于550-555nm范围内的任意固定波长的测量都被认为可以接受的。作为一种选择，该薄膜可以于峰值区域被扫描并成功获得和使用其平均值或中间值。剂量计应该使用GEX公司生产的或其它等效的剂量计支架进行测量。

B3 薄膜厚度: GEX B3剂量计是大规模生产的产品，批间具有很高的一致性，以允许用户在测量过程中采用一个平均剂量计厚度。特定的平均厚度和变化率被测得、分配并印在每一个GEX B3剂量计的盒子上。

剂量率效应：没有已知的剂量率效应。

辐照温度警告： 当辐照温度超过60°C时使用B3薄膜产品时，用户需慎重。

辐照前保存：GEX提供不可逆的温度标签用以监视所有B3薄膜运输过程中的最高温度。如果记录的温度达到45°C或更高，请立即向GEX报告以便确定恰当的措施。未打开的包装请保存在环境温度下(15°C-30°C)

B3剂量计的包装设计用以给剂量计提供一个环境稳定的条件，对于WINdose剂量计包装，当保存在以上条件下，可以存放10年；而对于DoseStix剂量计包装，可以存放3年，尽管实际规定的货架寿命可能要短一些（参考每次运输附带的合格证明）。

环境条件：辐射变色薄膜剂量计响应函数受辐照时的温度和薄膜材料中的含水量的影响。B3剂量计产品通常都是放置在密封袋中提供的，以维持其被包装和密封时的特定受控环境。打了条码的B3剂量计包装应该保持密封状态直到辐照之后。未打条码的B3剂量计包装应该保持密封状态直到辐照之前。

UV紫外线暴露：B3辐射变色薄膜对紫外辐射敏感。因此，要控制无保护的薄膜剂量计被暴露在日光和荧光灯光源下。

校准：在近似于实际使用的条件下校准。这应该包括近似的实际加工条件下的时间和温度条件。

指导文件请参考：ISO/ASTM 51261和NPL Report CIRM 29。

-可用的校准范围: 1.0 kGy - 150 kGy或取决于用户的应用场合和对不确定度的要求。使用多片包装的剂量计或校准多个计量范围可以使扩展不确定度明显降低。

- 建议: GEX推荐使用专门设计用以捕捉日常加工条件的In-situ原位校准法。使用一个合适的校准模体或等价物（如ISO/ASTM51261及NPL CIRM Report 29所述）以配合将传递标准剂量计相对被校验的常规剂量计定位在控制的距离，并帮助保持一个可重复的具有相同条件的几何形状（见参考资料）。

剂量计批校准应该在正常加工（包括温度）条件下完成。剂量计应该在与日常生产剂量测定一致的一定的时间间隔后被读取，这可能包括多倍时间间隔的各个读数。这些数据可以用于分析确定颜色形成周期的特性以及确立可能需要的颜色形成的修正因子。

辐照后稳定性： B3辐射变色薄膜材料辐照后的着色可能需要一定的持续时间，从而导致测得的响应值的变化。为了消除剂量计响应的变化，B3薄膜剂量计的辐照后热处理可以被用来完成颜色的形成周期并使得B3剂量计在辐照后100%保持稳定。经恰当地热处理的剂量计将保持稳定超过一年的时间。

因此，为了达到最佳的性能，GEX公司建议对所有的B3剂量计产品使用辐照后热处理（58.5°C 保持5-15分钟，具体时间客户需验证），对于目前的建议以及关于专门设计用于*B3 WINdose*和*B3 DoseStix*剂量计特别热处理装置的信息，请访问我们的网站www.sunplume.com，或直接与我们联系。

静电和辐照变色薄膜的表面：静电环境可能导致微粒被吸引到剂量计的表面从而导致读出错误。使用软刷或一片抗静电软布清除可见的微粒。

剂量计识别号：一个批号和唯一的剂量计识别号可以在每一个*B3 WINdose*和*B3 DoseStix*剂量计上找到。这给用户提供了绝对的剂量计确认信息，剂量计厚度信息也可以在产品包装盒上被找到。

打了条码的剂量计包装：某些 *B3 WINdose* 和所有的 *B3 DoseStix* 包装上都包含有条码，它可以被用于将唯一的剂量计识别号码数据直接自动地输入到基于电脑的数据跟踪和剂量计软件系统。*B3 DoseStix* 剂量计条码可以通过包装上的窗口读取。

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Usage:

Application: Applies to all products manufactured with B3 Film including *B3WINdose* and *B3DoseStix* radiochromic film products.

Wavelength and Measurement Readout Instructions: B3 dosimeters have historically been measured at 554nm over the entire range of use. The absorbance wavelength peak has more recently been approximated to be 552 nm. Because of the broad peak of the B3 film, measurement at any fixed wavelength between 550 – 554nm is considered acceptable. Alternatively, the film can be scanned over the peak area and an average mean or median value can be obtained and used successfully. Dosimeters should be measured using a GEX manufactured dosimeter holder or equivalent.

B3 film thickness: GEX B3 dosimeters are manufactured in large, highly uniform batches that allow users to apply an average dosimeter thickness in the measurement process. A specified average thickness and variability is measured, assigned and printed on each box of GEX B3 dosimeters.

Dose rate effects: There are no known dose rate effects.

Irradiation Temperature Caution: Use of B3 Film products in irradiation temperatures above 60°C are at the user's discretion.

Pre-Irradiation Storage: GEX provides irreversible thermal labels to monitor maximum temperature on all B3 film shipments. Report any recorded temperatures of 45°C or higher directly to GEX so that appropriate actions can be determined. Store unopened packages under ambient conditions (15°C to 30°C). The packaging of B3 dosimeters is designed to provide an environmentally stable condition for the dosimeters when stored under the above conditions. The stable condition for *B3WINdose* dosimeter packages is 10 years, and 3 years for *B3DoseStix* dosimeter packages, though stated shelf life may be less (refer to the Certificate of Compliance which accompanies each shipment).

Environmental Conditions: The response function of radiochromic film dosimeters is affected by the temperature and the water content in the film material at the time of irradiation. B3 dosimeter products are typically supplied in sealed pouches to maintain the specific controlled environment in which they were packaged and sealed. Barcoded B3 dosimeter packages should remain sealed until after exposure. Non-barcoded B3 dosimeter packages should remain sealed until immediately before the time of exposure.

UV Exposure: The B3 radiochromic film is sensitive to UV radiation. Therefore, control exposure of unprotected film dosimeters to daylight and fluorescent light sources.

Calibration: Calibrate under conditions approximating actual usage. This should include time and temperature conditions that approximate actual process conditions. For guidance, see: ISO/ASTM 51261 and NPL Report CIRM 29.

- ***Usable Calibration Range*:** 1.0 kGy - 150 kGy or as determined by user's application and uncertainty requirements. Using multiple replicate packaged dosimeters or calibrating multiple dose ranges can result in significant reductions in expanded uncertainty.

- ***Recommendation:*** GEX recommends using an in-situ calibration method designed to capture routine process conditions whenever possible. Use an appropriate calibration phantom or equivalent (as described in ISO/ASTM 51261 and NPL CIRM Report 29) to co-locate the transfer standard dosimeters in controlled proximity to the routine dosimeters being calibrated taking care to maintain a repeatable geometry with equilibrium conditions (see references).

The dosimeter batch calibration should be accomplished under normal process (including temperature) conditions. Dosimeters should be read at a time interval(s) consistent with routine production dosimetry. This may include readings at multiple time intervals, which are analyzed to determine the specifics of the color development cycle and to establish a correction factor for color development if necessary.

Post Irradiation Stability: The coloration of B3 radiochromic film material may continue to develop for

some period of time after irradiation, causing the measured response values to change. To eliminate dosimeter response variance, post-irradiation heat treatment of B3 film dosimeters can be used to complete the color development cycle and render B3 dosimeters as 100% post-irradiation stable. Dosimeters that have been properly heat treated will remain stable for more than a year.

Therefore, for optimum performance, GEX recommends a post-irradiation heat treatment process be used for all B3 dosimeter products. The user should validate the heat treatment method used. For current recommendations and information regarding special heat treatment equipment designed specifically for *B3 WINdose* and *B3 DoseStix* dosimeters, visit our website, www.gexcorp.com, or contact GEX directly.

Static and Radiochromic Film Surface: Static conditions may cause particulate to be drawn to the dosimeter surface which can cause readout error. Remove visible particulate with a soft brush or piece of soft anti-static cloth.

Dosimeter Identifications: A batch ID and unique dosimeter identification number is found on each *B3WINdose* and *B3DoseStix* dosimeter. This provides users with absolute dosimeter verification information. Dosimeter thickness information may be found on the product box.

Barcoded Dosimeter Packages: Some *B3WINdose* and all *B3DoseStix* packages contain barcodes that can be used to provide automated data entry of the unique dosimeter ID numbers directly to computer based data tracking and dosimetry software systems. The *B3 DoseStix* barcodes can be read through the packaging window.

References:

1) "A New Radiochromic Thin Film Dosimeter System", A. Miller et al, Radiation Physics and Chemistry Volume 31 pp. 491-496, 1988 International Journal Radiation Applications and Instrumentation, Part C. Printed in Great Britain.

2) ISO/ASTM Standard Practice 51275 - Standard Practice for Use of a Radiochromic Film Dosimetry System.

3) ISO/ASTM Standard Guide 51261 - Standard Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing. NPL Report CIRM 29; Guidelines for the Calibration of Dosimeters for Use in Radiation Processing.

4) "Temperature, Humidity and Time. Combined Effects on Radiochromic Film Dosimeters", A. A. Abdel-Fattah and Arne Miller, Radiation. Phys. Chem. Vol. 47, No. 4, pp.611-621, 1996; Elsevier Science Ltd, Great Britain.

5) "Guidelines for the Calibration of Dosimeters for use in Radiation Processing", Peter Sharpe and Arne Miller, Report CIRM 29.