ShowTex

AMAZING STAGE FABRICS IN MOTION

BLACKOUT FLEX BB

TECHNICAL DATA SHEET

March 2018

Blackout Flex BB is the perfect blackout fabric to combine with AV Drop or Print Frame Profiles by ShowTex. It's black backing prevents visible bracing and interference from light coming from the back. Blackout Flex BB is 100% PVC-free.

» ARTICLE CODE	» WIDTH	» LENGTH	» WEIGHT
1268 0320 0665	320 cm	± 50 m	280 g/m²
1268 0500 0665	500 cm	± 50 m	280 g/m²

» COMPOSITION

100% PES with PUR coating

» FLAME RESISTANCE

NF P 92-503	CLASS M1
DIN 4102	CLASS B1

» AVAILABLE COLOURS

FRONT

BACK

KU LEUVEN

LABORATORIUM VOOR LICHTTECHNOLOGIE

ORDER LLI/279

Test report

Determination of the reflection and transmission properties of 2 test samples

Gent, 13 03 2017
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By order of
Showtex nv
Oude Gentweg 100,
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11 pages

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SUMMARY

This document reports on the determination of the reflection and transmission properties of 2 test samples by aid of Bidirectional Scatter Distribution Function (BSDF) measurements. The spectral radiance factor as well as the luminance factor (in combination with Ill. A) was determined for a perpendicular incident illumination, with viewing angles ranging in one plane from 0° to 40° as seen from the surface normal, in both reflection and transmission hemisphere.

All measurements were performed in the home-built bidirectional scatter distribution function measurement device, built according to the procedure determined in ASTM[1] standard E2387, 'Standard Practice for Goniometric Optical Scatter Measurements'.

[1] ASTM – American Society for Testing and Materials

1 APPLICATION FOR TESTING

On 20/02/2017, the Light & Lighting Laboratory received the request from Showtex nv to determine the reflection and transmission properties of 2 test objects, marked:

- Blackout Flex BB,
- New Backlit Film

The spatial distribution of the spectral radiance factor β and of the luminance factor β_v, after incorporation of a standard illuminant (i.e., ill. A) and the eye sensitivity function, were to be determined.

2 MEASUREMENT METHOD

The spectral radiance factor β is defined as the ratio of the surface radiance of a sample in a particular viewing direction to the radiance of the perfect reflecting or transmitting diffuser, identically irradiated and viewed:

$$\beta(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)=\frac{dL_{e,s}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)}{dL_{e,s,PSD}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)}, \tag{1}$$

with $\beta(\theta_i,\phi_i;\theta_t,\phi_t;\lambda)$ the spectral radiance factor at wavelength λ, (θ_i,ϕ_i) the spherical coordinates of the light incident on the surface, (θ_s,ϕ_s) the spherical coordinates of the light scattered from the surface, $dL_{e,s}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)$ and $dL_{e,s,PSD}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)$ being the differential spectral radiance from a differential solid angle of the sample under test and of the perfect scattering (reflecting or transmitting) diffuser, respectively. The spherical coordinates are referenced to the surface normal.

The perfect reflecting or transmitting diffuser is in fact a theoretical concept, defined as a diffuser which exhibits an isotropic diffuse reflection, resp. transmission, with a reflectance resp. transmittance equal to one.

In practice, this theoretical diffuser can be approximated by a matte, neutral white, reference standard with nearly Lambertian reflection characteristics. The relation between the spectral radiance of a practical reference standard, $dL_{e,s,REF}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)$, and the spectral radiance of the theoretical perfect diffuser, $dL_{e,s,PSD}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)$, can be formulated from the definition of the radiance factor (Eq. 1):

$$\beta_{REF}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)=\frac{dL_{e,s,REF}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)}{dL_{e,s,PSD}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)}. \tag{2}$$

In result, the spectral radiance factor of a test sample can be calculated as

$$\beta_{Test}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)=\frac{dL_{e,s,Test}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)}{dL_{e,s,REF}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda)}.\beta_{REF}(\theta_i,\phi_i;\theta_s,\phi_s;\lambda). \tag{3}$$

The photometric counterpart of the radiance factor is the so-called luminance factor β_v, defined as the ratio of the luminance of a surface element in a given direction, L_{Test}, to that of the perfect reflecting or transmitting diffuser, L_{PSD}, identically illuminated and viewed:

$$\beta_v(\theta_i,\phi_i;\theta_t,\phi_t)=\frac{L_{Test}}{L_{PSD}}. \tag{4}$$

The luminance factor can be calculated from the spectral radiance factor by taking into account the spectral distribution of an illuminant (Ill. A), and the eye sensitivity function $V(\lambda)$, according to the same procedure as discussed above.

At the Light & Lighting Laboratory, a device to determine the radiance and luminance factor according to the described procedure has been built. For the requested measurements, the following measurement characteristics were installed:

Parameter	**Setting**
Number of measurements	Average of 5 measurements/viewing angle
Measurement time	max. 10 s
pinhole diameter light source	0.5 mm
light source	Xe 300W, unpolarized
detector diameter	25.4 cm
distance detector - sample	878 mm
Reference standard	PTB 95/42

Table 1: Description of measurement parameters used during tests.

Measurements were performed for normal incident light ($\theta_i = 0°$), with viewing angles θ_s ranging in one orthogonal plane ($\phi_s = 0°$) from 0° to 40°, in the reflection as well as in the transmission hemisphere.

3 TEST RESULTS

The test samples were received on 21/02/2017. The measurements were performed on 10/03/2017.

3.1 Blackout Flex BB

The calculated spectral radiance factor at wavelength 400 nm, 500 nm, and 600 nm, together with the calculated luminance factor, is reported as a function of viewing angle in Table 1 and Table 2, for viewing in the reflection and transmission hemisphere, respectively. A graphical representation of the spectral radiance factor (reflection hemisphere) as a function of wavelength is presented in Fig. 1. A graphical representation of the luminance factor as a function of viewing angle in the reflection hemisphere is depicted in Fig. 2.

	3°	5°	10°	20°	30°	40°
β_{400nm}	0.196	0.191	0.177	0.156	0.138	0.128
β_{500nm}	0.928	0.929	0.925	0.926	0.932	0.948
β_{600nm}	0.833	0.835	0.824	0.814	0.807	0.811
β_v	0.855	0.855	0.847	0.840	0.837	0.844

Table 1: Calculated spectral radiance factor and luminance factor as a function of wavelength in the reflection hemisphere.

	0°	5°	10°	20°	30°	40°
β_{400nm}	0.0002	0.0003	0.0001	0.0001	0.0001	0.0002
β_{500nm}	0.0002	0.0004	0.0002	0.0002	0.0001	0.0001
β_{600nm}	0.0005	0.0005	0.0002	0.0002	0.0001	0.0001
β_v	0.0004	0.0005	0.0003	0.0002	0.0001	0.0001

Table 2: Calculated spectral radiance factor and luminance factor as a function of wavelength in the transmission hemisphere.

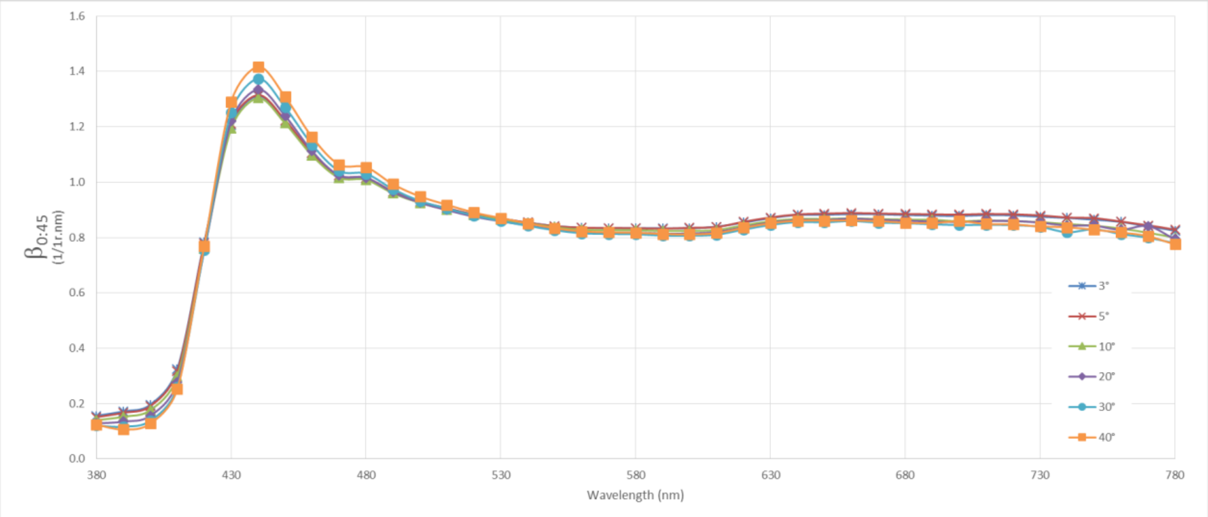

Fig. 1: Graphical representation of the spectral radiance factor (reflection hemisphere) as a function of wavelength.

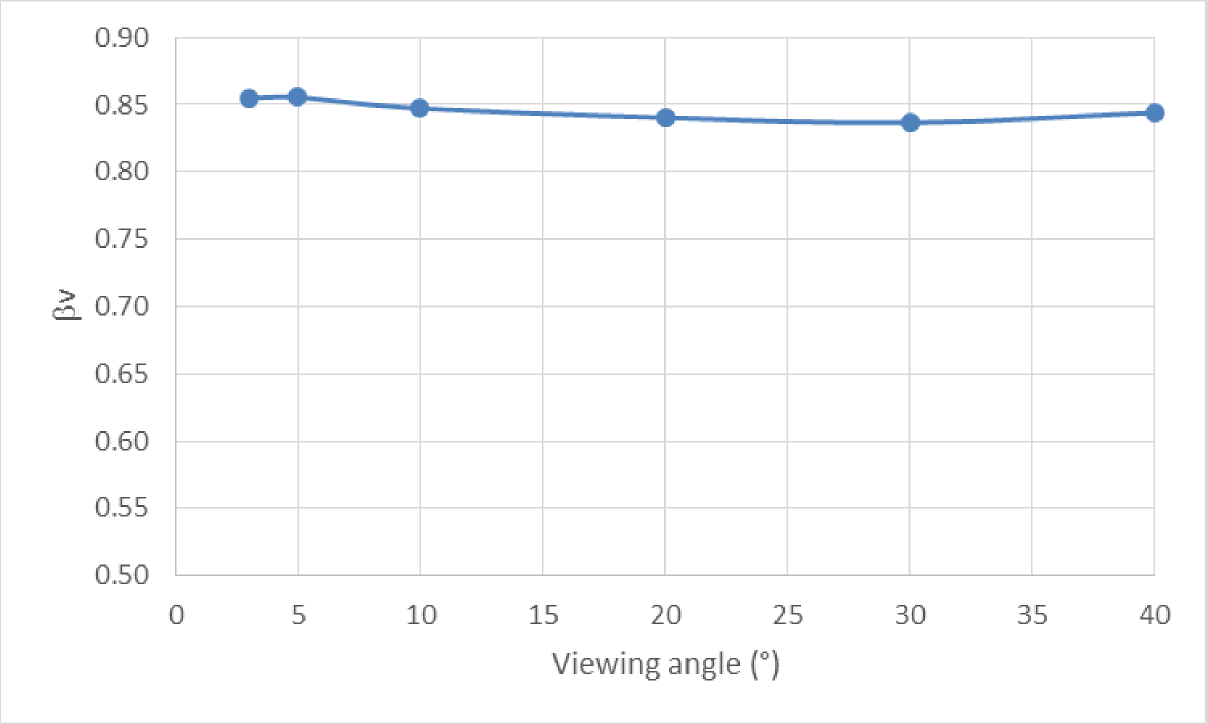

Fig. 2: Spatial distribution of the luminance factor in the reflection hemisphere.

3.2 New Backlit Film

The calculated spectral radiance factor at wavelength 400 nm, 500 nm, and 600 nm, together with the calculated luminance factor, is reported as a function of viewing angle in Table 3 and Table 4, for viewing in the reflection and transmission hemisphere, respectively. A graphical representation of the spectral radiance factor (reflection hemisphere) as a function of wavelength is presented in Fig. 3. A graphical representation of the luminance factor as a function of viewing angle in the reflection hemisphere is depicted in Fig. 4.

	3°	5°	10°	20°	30°	40°
β_{400nm}	0.562	0.581	0.512	0.336	0.286	0.279
β_{500nm}	0.891	0.918	0.916	0.944	0.941	0.953
β_{600nm}	0.822	0.847	0.835	0.829	0.824	0.836
β_v	0.837	0.863	0.854	0.856	0.851	0.863

Table 3: Calculated spectral radiance factor and luminance factor as a function of wavelength in the reflection hemisphere.

	0°	5°	10°	20°	30°	40°
β_{400nm}	0.035	0.035	0.036	0.036	0.035	0.035
β_{500nm}	0.445	0.449	0.463	0.469	0.472	0.474
β_{600nm}	0.540	0.524	0.513	0.503	0.503	0.503
β_v	0.511	0.502	0.497	0.491	0.492	0.492

Table 4: Calculated spectral radiance factor and luminance factor as a function of wavelength in the transmission hemisphere.

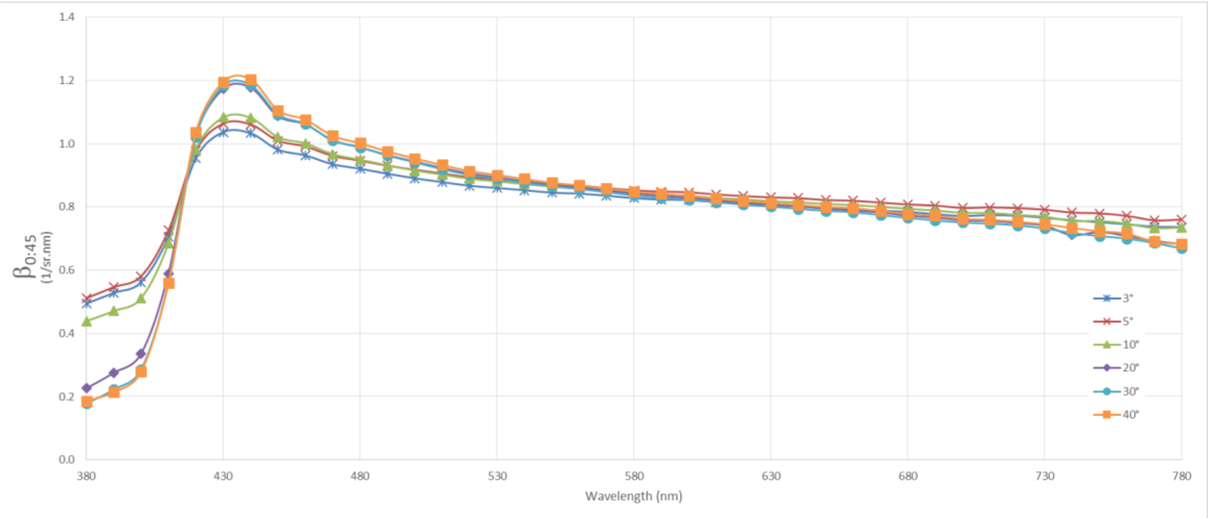

Fig. 3: Graphical representation of the spectral radiance factor (reflection hemisphere) as a function of wavelength.

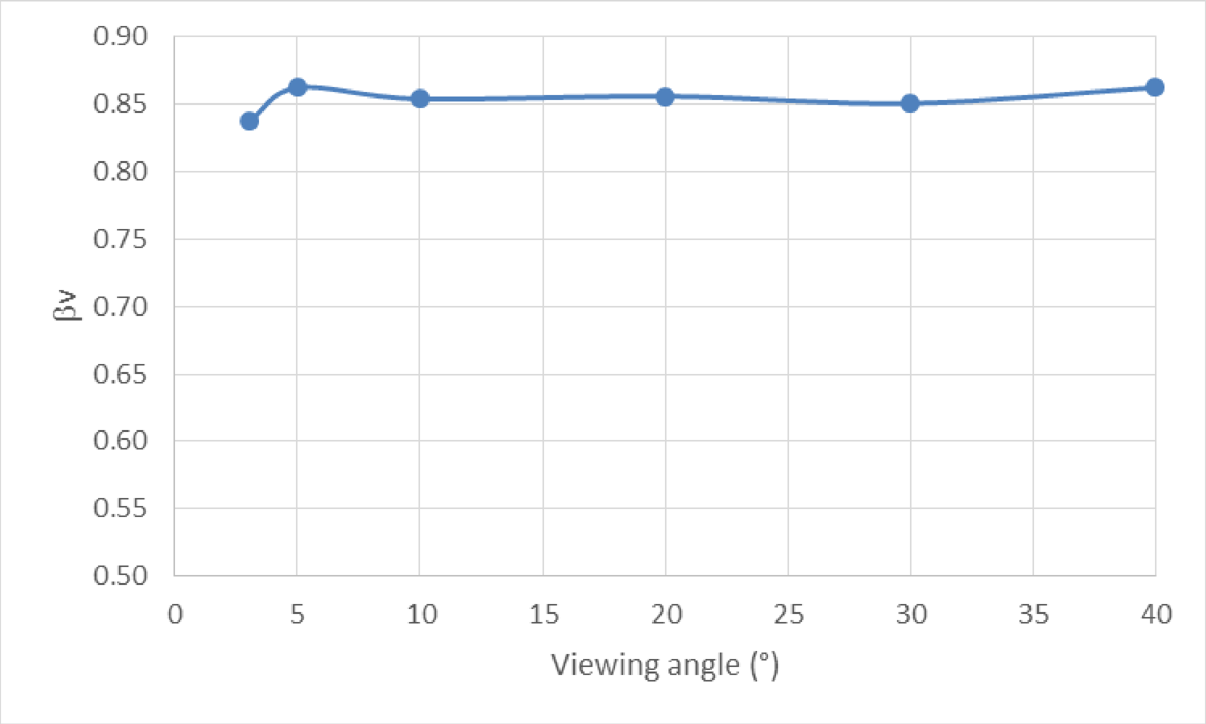

Fig. 4. Spatial distribution of the luminance factor in the reflection hemisphere.

END OF THE REPORT