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|--|-------------------------|----------------------------|
| LAUDO TÉCNICO | Data: 30/11/2023 | Película: Nanocerâmica 20% |
| Elaborado por: Vittor Andrade Revisado por: Thaynnara Siqueira Aprovado por: Hernane Fernandes | Lote: NN20130321 | |

Introdução

O presente relatório tem por objetivo apresentar o resultado dos testes feitos com as películas Bluetech Window Films®, bem como a análise e efetiva comprovação de suas características, sendo exemplos de avaliação o haze (embaçamento), percentual de luz visível transmitida, retenção de raios e infravermelhos ultravioleta, durabilidade, resistência (impactos mecânicos), entre outros.

Normas técnicas

Todos os testes conduzidos pelo Departamento de Auditoria e Qualidade da Bluetech Window Films® são orientados segundo normas técnicas estabelecidas pela American Society for Testing and Materials (ASTM), Normas Nacionais da República Popular da China (GB) e pela The industry standard of the People's Republic of China (JGJ) seguindo rigorosos padrões de qualidade, a fim de constatar os atributos físicos de todas as películas comercializadas pela marca. Desta forma, as normas utilizadas nas aferições das amostras são:

- TH-100: Norma ASTM D1003;
- CS-700: Norma ASTM D1003/D1044;
- GlasSpec-2500: Norma térmica JGJ/T151 e Norma ótica GB/T2680;
- Q-SUN XE-1: Norma ASTM D3424 - 01.

Maquinário

Para avaliação detalhada das películas, o laboratório de controle e qualidade da Bluetech Window Films® conta com os seguintes equipamentos:

- CHN Spec modelo TH-100;
- CHN Spec modelo CS-700;
- GlasSpec-2500;
- Microscópio - Trinocular ótica finita acromático 1600x Mod. NO216T4 com Monitor. Lentes Plan 10/0.25, 4/0.10, 40/0.65, 100/1.25.
- Q-SUN modelo XE-1.

Índice

| | |
|---|----|
| Aferições haze TH-100 | 3 |
| Tabela haze e transmitância TH-100 | 4 |
| Aferições haze CS-700 | 5 |
| Gráfico de Colorimetria | 6 |
| Curva espectral de luz visível | 7 |
| Diagrama de cromaticidade | 8 |
| Tabela haze e transmitância CS-700 | 9 |
| Padrões óticos e térmicos | 10 |
| Gráfico do espectro solar | 11 |
| Análise no microscópio (disposição da cola na película) | 12 |

Multiple test report

Company name: BLUETECH

Department: AUDITORIA E QUALIDADE

SMP name:

test Title: HAZE E TONALIDADE

Light: D65

| Name | Test Mode | Haze | Total Tran | DT | DHaze | 400nm | 420nm | 410nm | 430nm |
|---------------------|-----------|------|------------|--------|-------|-------|-------|-------|-------|
| Target | ASTM | 0.00 | 100.00 | - | - | 0.00 | 0.00 | 0.00 | 0.00 |
| NN20130 321 - M1 | ASTM | 2.02 | 18.79 | -81.21 | 2.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| NN20130 321 - M1 | ASTM | 2.06 | 18.88 | -81.12 | 2.06 | 0.00 | 0.00 | 0.00 | 0.00 |
| NN20130 321 - M1 | ASTM | 2.28 | 18.78 | -81.22 | 2.28 | 0.00 | 0.00 | 0.00 | 0.00 |
| NN20130 321 - M1 | ASTM | 2.04 | 18.68 | -81.32 | 2.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| NN20130 321 - M1 | ASTM | 2.69 | 18.86 | -81.14 | 2.69 | 0.00 | 0.00 | 0.00 | 0.00 |
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| Remark: | | | | | | | | | |

Tester:

check:VITTOR A.

Data:

HAZE E TONALIDADEDefault 1024.st5

corp: BLUETECH

Department: AUDITORIA E QUALIDADE tester:VITTOR A.

| <u>Standard</u> | <u>Light</u> | <u>Standard</u> | <u>Haze</u> | <u>Total Tran</u> | <u>DT</u> | <u>DHaze</u> | <u>400nm</u> | <u>420nm</u> | <u>410nm</u> | <u>430nm</u> |
|-------------------|--------------|-----------------|-------------|-------------------|-----------|--------------|--------------|--------------|--------------|--------------|
| ■ Target | D65 | ASTM | 0.00 | 100.00 | - | - | 0.00 | 0.00 | 0.00 | 0.00 |
| <u>Sample</u> | <u>Light</u> | <u>Standard</u> | <u>Haze</u> | <u>Total Tran</u> | <u>DT</u> | <u>DHaze</u> | <u>400nm</u> | <u>420nm</u> | <u>410nm</u> | <u>430nm</u> |
| ■ NN20130321 - M1 | D65 | ASTM | 2.02 | 18.79 | -81.21 | 2.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| ■ NN20130321 - M1 | D65 | ASTM | 2.06 | 18.88 | -81.12 | 2.06 | 0.00 | 0.00 | 0.00 | 0.00 |
| ■ NN20130321 - M1 | D65 | ASTM | 2.28 | 18.78 | -81.22 | 2.28 | 0.00 | 0.00 | 0.00 | 0.00 |
| ■ NN20130321 - M1 | D65 | ASTM | 2.04 | 18.68 | -81.32 | 2.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| ■ NN20130321 - M1 | D65 | ASTM | 2.69 | 18.86 | -81.14 | 2.69 | 0.00 | 0.00 | 0.00 | 0.00 |

Multiple test report

Company name: BLUETECH

Department: AUDITORIA E QUALIDADE

SMP name:

test Title: HAZE E TONALIDADE

light /angle: D65/2°

| Name | Test Mode | Haze | Total Tran | DT | DHaze | 400nm | 420nm | 410nm | 430nm |
|---------------------|-----------|------|------------|--------|-------|-------|-------|--------|-------|
| Target | ASTM | 0.01 | 99.83 | - | - | 98.68 | 99.65 | 100.55 | 99.96 |
| NN20130 321 - M1 | ASTM | 1.99 | 18.86 | -80.98 | 1.98 | 15.01 | 16.63 | 16.55 | 17.53 |
| NN20130 321 - M1 | ASTM | 2.14 | 18.72 | -81.12 | 2.13 | 13.41 | 15.88 | 15.09 | 16.96 |
| NN20130 321 - M1 | ASTM | 1.97 | 18.63 | -81.20 | 1.95 | 13.37 | 15.85 | 15.43 | 17.10 |
| NN20130 321 - M1 | ASTM | 2.13 | 18.56 | -81.28 | 2.12 | 12.82 | 16.11 | 15.21 | 16.81 |
| NN20130 321 - M1 | ASTM | 2.33 | 18.67 | -81.17 | 2.32 | 14.10 | 16.31 | 15.63 | 16.67 |
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| Remark: | | | | | | | | | |

Tester:

check:VITTOR A.

Data:

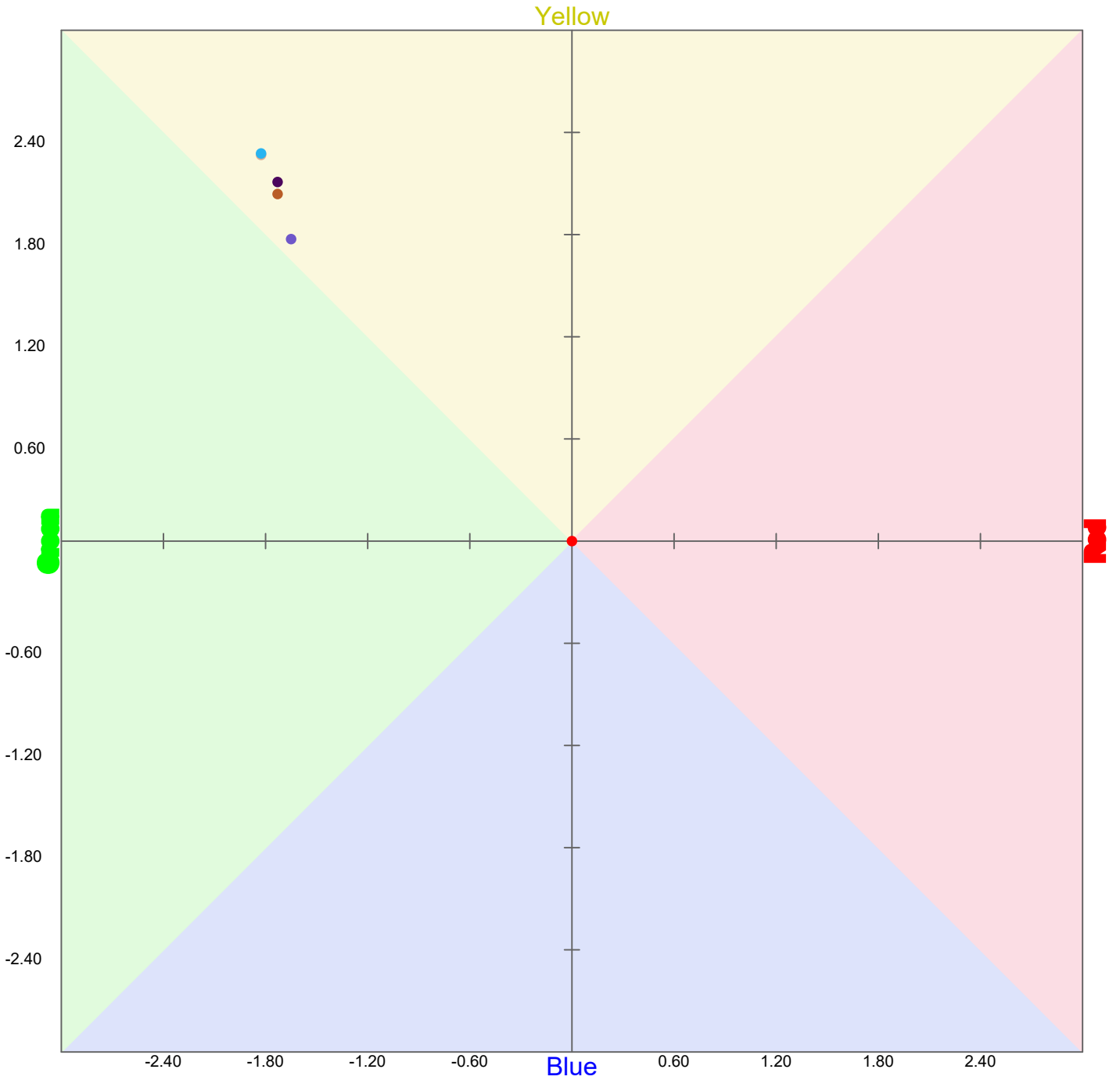
HAZE E TONALIDADE

Default 1024.st5

corp: BLUETECH

Department: AUDITORIA E QUALIDADE

tester: VITTOR A.

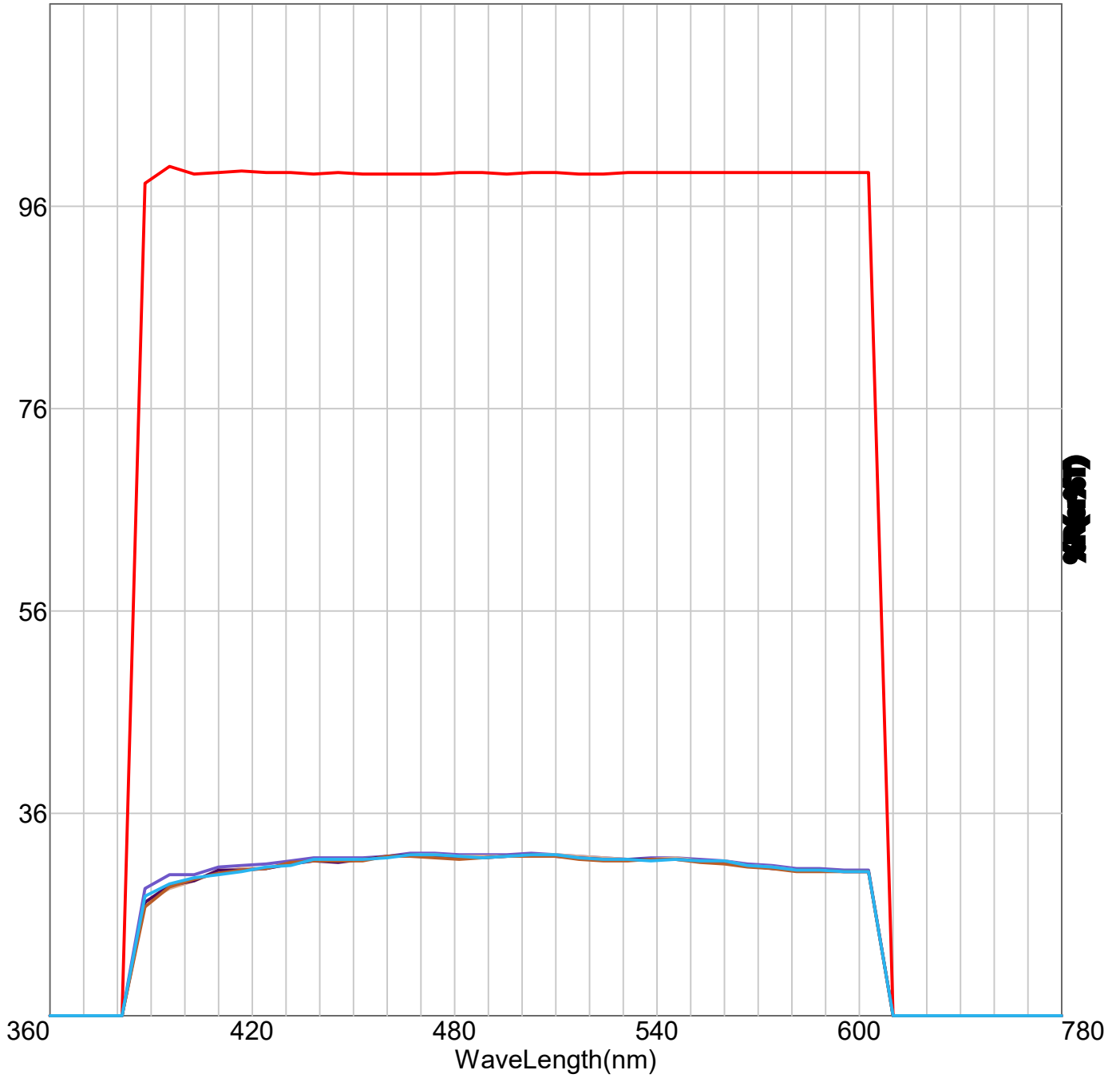


HAZE E TONALIDADE

Default 1024.st5

corp: BLUETECH

Department: AUDITORIA E QUALIDADE tester:VITTOR A.



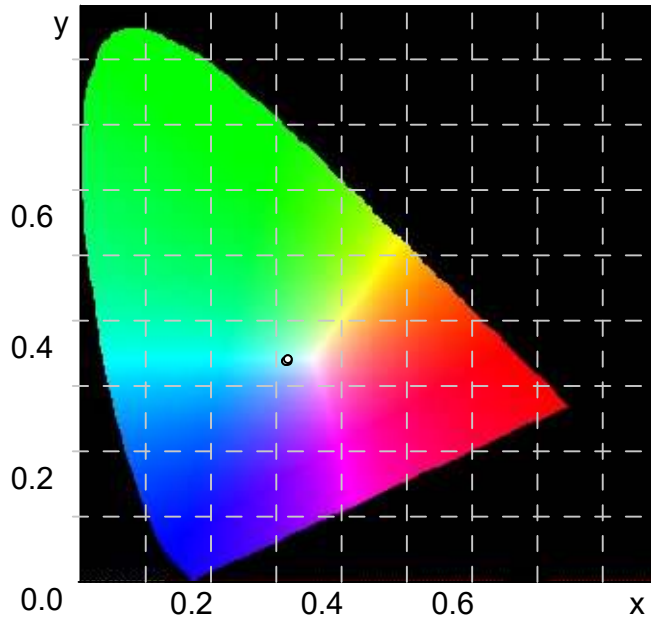
HAZE E TONALIDADE

Default 1024.st5

corp: BLUETECH

Department: AUDITORIA E QUALIDADE

tester: VITTOR A.



HAZE E TONALIDADEDefault 1024.st5

corp: BLUETECH

Department: AUDITORIA E QUALIDADE tester:VITTOR A.

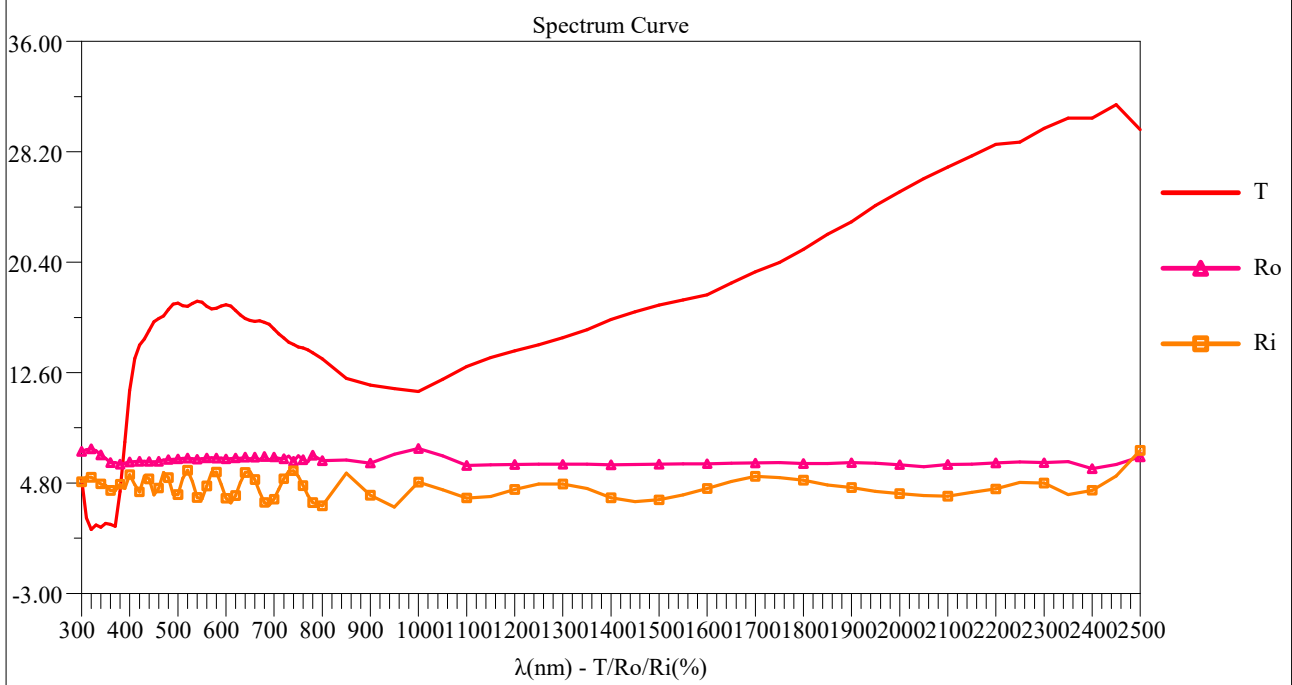
| <u>Standard</u> | <u>Light</u> | <u>Standard</u> | <u>Haze</u> | <u>Total Tran</u> | <u>DT</u> | <u>DHaze</u> | <u>400nm</u> | <u>420nm</u> | <u>410nm</u> | <u>430nm</u> |
|-------------------|--------------|-----------------|-------------|-------------------|-----------|--------------|--------------|--------------|--------------|--------------|
| ■ Target | D65/2° | ASTM | 0.01 | 99.83 | - | - | 98.68 | 99.65 | 100.55 | 99.83 |
| <u>Sample</u> | <u>Light</u> | <u>Standard</u> | <u>Haze</u> | <u>Total Tran</u> | <u>DT</u> | <u>DHaze</u> | <u>400nm</u> | <u>420nm</u> | <u>410nm</u> | <u>430nm</u> |
| ■ NN20130321 - M1 | D65/2° | ASTM | 1.99 | 18.86 | -80.98 | 1.98 | 15.01 | 16.63 | 16.55 | 17.12 |
| ■ NN20130321 - M1 | D65/2° | ASTM | 2.14 | 18.72 | -81.12 | 2.13 | 13.41 | 15.88 | 15.09 | 16.12 |
| ■ NN20130321 - M1 | D65/2° | ASTM | 1.97 | 18.63 | -81.20 | 1.95 | 13.37 | 15.85 | 15.43 | 17.12 |
| ■ NN20130321 - M1 | D65/2° | ASTM | 2.13 | 18.56 | -81.28 | 2.12 | 12.82 | 16.11 | 15.21 | 16.12 |
| ■ NN20130321 - M1 | D65/2° | ASTM | 2.33 | 18.67 | -81.17 | 2.32 | 14.10 | 16.31 | 15.63 | 16.12 |

GlasSpec2500 Optical and Thermal Parameters Measuring Instrument Test Report

Instrument: GlasSpec2500 Thermal standard: JGJ/T 151 Date: 2023-09-25 Test No.: _____
 CIE: D65/2° Optical standard: GB/T 2680 Time: 08:00:14 Environment: _____

Structure: 0.0(1#Low-E, 0.880)

| No. | Content | Results |
|-----|---|---------|
| 1 | UV transmittance τ_{uv} | 0.021 |
| 2 | Visible light transmittance τ_v | 0.173 |
| 3 | Visible light reflectance ρ_v | 0.065 |
| 4 | Inside visible light reflectance $\rho_{v,i}$ | 0.046 |
| 5 | Solar direct transmittance τ_e | 0.151 |
| 6 | Solar direct reflectance ρ_e | 0.064 |
| 7 | Inside solar direct reflectance $\rho_{e,i}$ | 0.045 |
| 8 | Solar direct absorptance a_e | 0.784 |
| 9 | Solar infrared direct transmittance τ_{IR} | 0.149 |
| 10 | Solar infrared direct reflectance ρ_{IR} | 0.063 |
| 11 | Total solar energy transmittance g | 0.351 |
| 12 | Shading coefficient SC | 0.403 |
| 13 | Total solar infrared heat transmittance g_{IR} | 0.349 |
| 14 | Visible light to total solar energy transmittance LSG | 0.49 |
| 15 | Thermal transmittance $K(W/(m^2 \cdot K))$ | 5.39 |



Notes:

1. K is calculated according to the winter condition of JGJ/T 151
2. g/g_{IR} is calculated according to the summer condition of JGJ/T 151
3. The optical parameters are calculated according to standard GB/T 2680, $SC = g/0.87$
4. The spectral curve is plotted at spectral intervals in standard GB/T 2680

Tester: _____

Verification: _____

| | |
|---------------|--|
| Solar | Solar direct transmittance te: 0.151 |
| | Solar direct reflectance pe: 0.064 |
| | Solar direct absorptance ae: 0.784 |
| Visible light | Visible light transmittance tv: 0.173 |
| | Visible light reflectance pv: 0.065 |
| NIR | Solar infrared direct transmittance tIR: 0.149 |
| | Solar infrared direct reflectance pIR: 0.063 |
| Thermal | Total solar energy transmittance g: 0.351 |
| | Shading coefficient SC: 0.403 |
| | Total solar infrared heat transmittance gIR: 0.349 |
| | Light to solar gain LSG: 0.49 |
| | Thermal transmittance K: 5.39 W/(m ² K) |

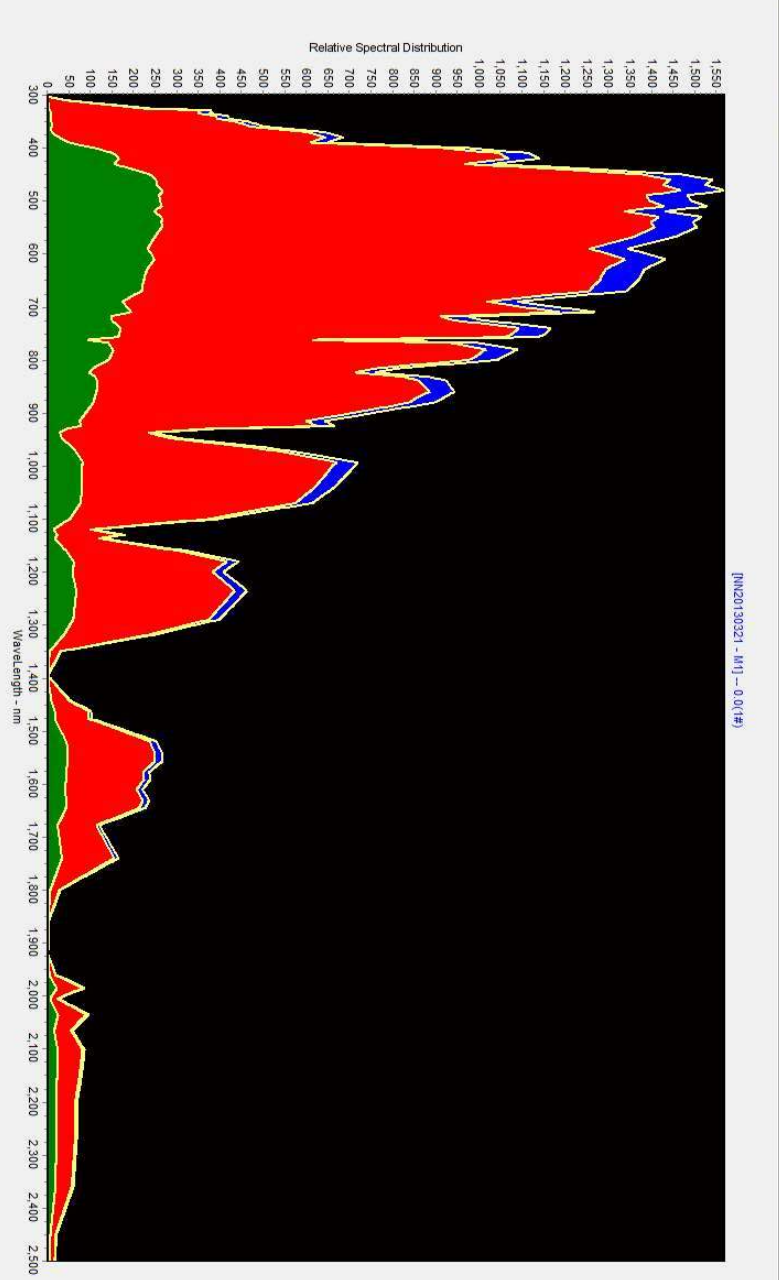
>> Measurement control information

Normal

T: **0.04:15** R: **0.02:28**

D65/2° Batch BLUETECH

>> T-R-A Graph at AM1.5



>> Glass Structure File:[NN20130321 - M1] Structure:0.0(4#) CurrentData:Total

JG/T 151
GB/T 2680

Outdoor Indoor

T-R-A Graph at AM1.5 Status: Normal

Overlay Spectrum

| No. | Name | T | Ro | Ri |
|-----|-------------------|-----|--------|--------|
| 0 | Current Measuring | Red | Pink | Orange |
| 1 | NN20130321 - M1 | Red | Yellow | Cyan |

Name: T Automatic

NN20130321 - M1

Wizard

0 Internal Link

NN20130321 - SAMPLE - LENTE PLAN 10/0.25



NN20130321 - SAMPLE - LENTE PLAN 4/0.10



Assinatura do responsável

Vittor Andrade

Vittor Andrade
Auditor de Qualidade