



# CORDURA® Solution Dyed Nylon Fabrics Accelerated UV Testing

INVISTA CORDURA® Brand/Jan-2020

## Solution Dyed vs Piece Dye-Summary Results after UV fading



*This test Compares 4 Solution Dye Nylon (SDN) fabrics to 4 similar colored Piece Dye (PD) fabrics. Each fabric was exposed to accelerated Xenon Arc UV light for increments of 100/300/600/1000 AFU's (1 AFU=1.2 Hours) at INVISTA's Dalton Lab in 4Q16.*

### **The summary test results as follows:**

- SDN fabrics resists color fading after accelerated UV exposure with a Delta-E CMC advantage over PD ranging between 2 and 161-X depending on color.
- SDN fabrics resists color fading after accelerated UV exposure as shown by the attached comparison photos with exposures ranging between 100 and 1000 AFU.
- SDN fabrics resists color fading after accelerated UV exposure as shown by the IR reflectance graphs with almost “0” change through the visible IR spectrum.
- SDN fabrics resists Near-IR degradation after accelerated UV exposure as shown by the NIR reflectance graphs with almost “0” change through the NIR spectrum.
- Processing of SDN fabrics saves water, energy and reduces CO2 emissions. Savings over PD up to 1.87 Lts water, 1.63 MJ's energy and 0.11 kgs of CO2 per yard of fabric.

## Color Change after Accelerated Xenon Arc Exposure (DeCMC)



*SDN CORDURA® provides improved resistance to fade and color change after exposure to accelerated UV light.*

	Black De-CMC	Ranger Green De-CMC	Tan-499 De-CMC	Coyote-498 De-CMC
<b>SDN-Control</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
SDN-100 AFU	0.16	0.42	1.25	1.43
SDN-300 AFU	0.11	0.90	2.17	3.91
SDN-600 AFU	0.29	1.63	3.48	5.78
SDN-1000 AFU	0.11	2.84	4.84	6.79
<b>PD-Control</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
PD-100 AFU	0.91	1.95	1.62	1.27
PD-300 AFU	4.00	5.50	3.83	3.69
PD-600 AFU	10.01	9.76	6.30	6.84
PD-1000 AFU	16.96	13.97	9.60	11.00
<b>X's-Improved</b>	<b>161</b>	<b>5</b>	<b>2</b>	<b>2</b>

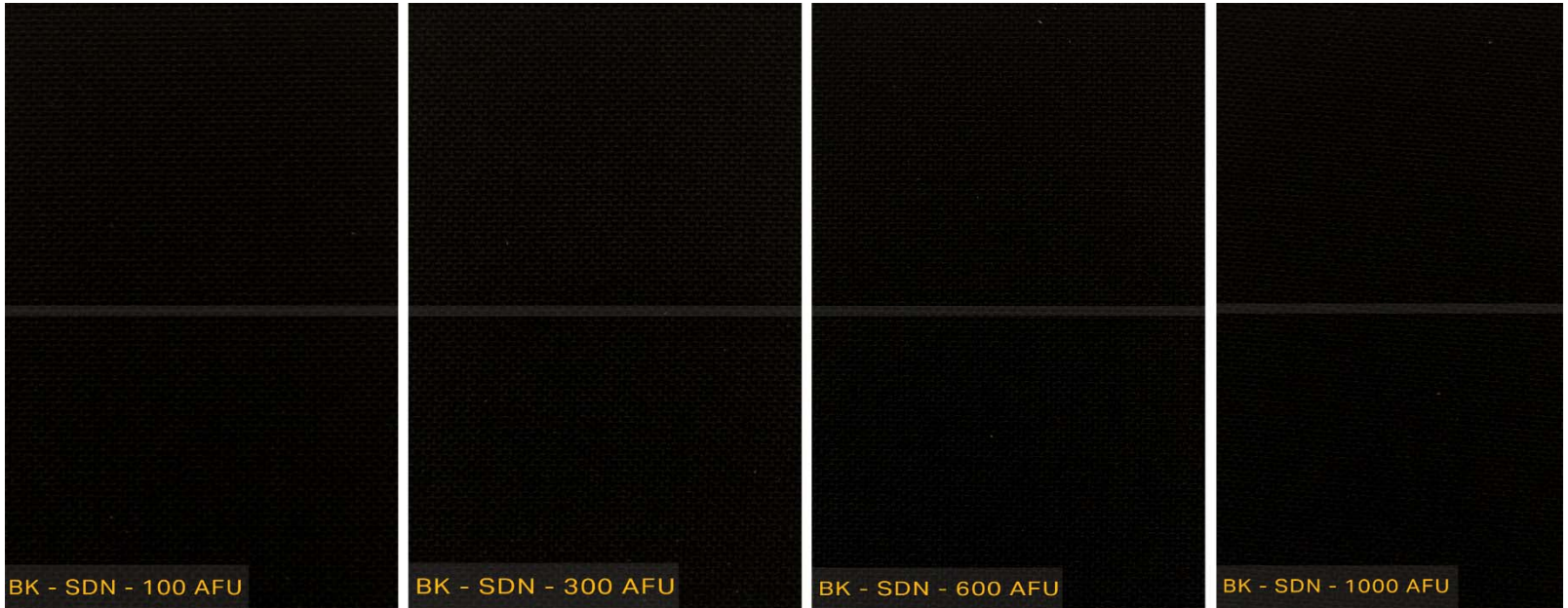
- Tested per AATCC-16E, INVISTA Dalton Labs Sep-Dec 2016.
- 1 AFU = 1.2 Hours

# Black-Accelerated Xenon Arc Exposure (Visual 100-1000 AFU)

**SDN**  
**Exposed**

---

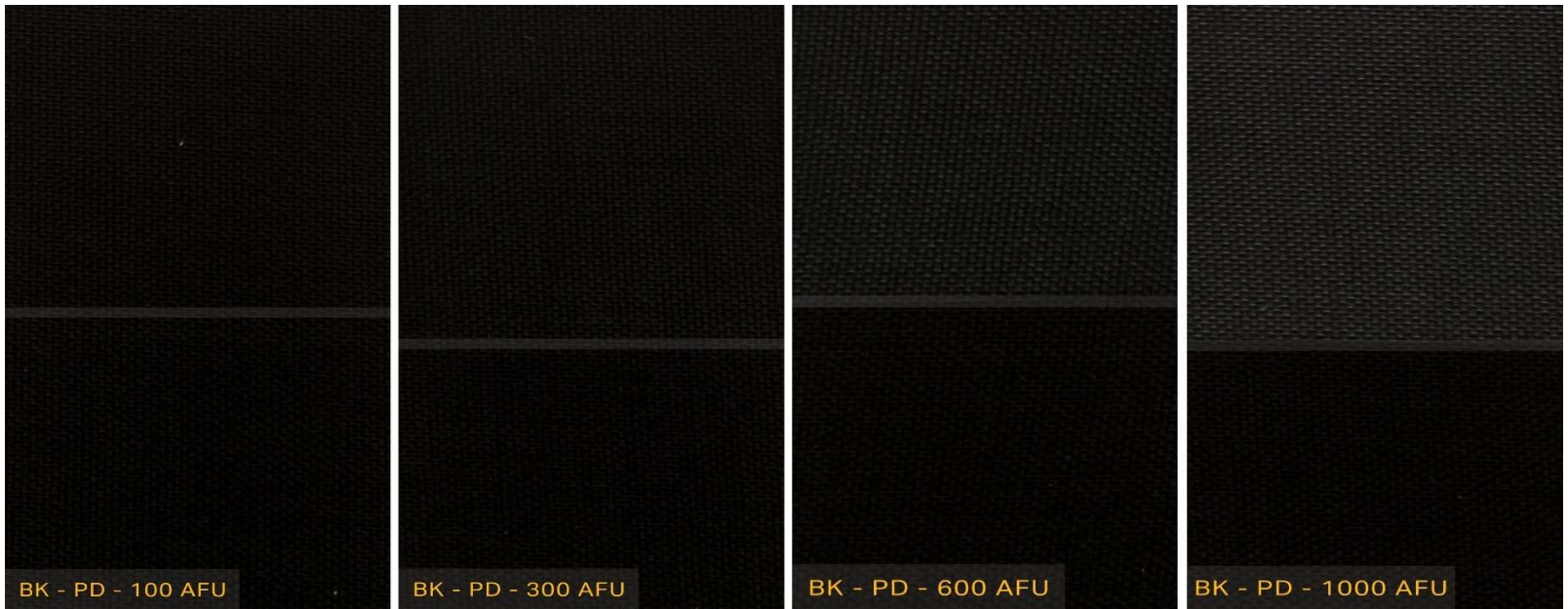
**SDN**  
**Covered**



**Piece Dye**  
**Exposed**

---

**Piece Dye**  
**Covered**



# Ranger Green-Accelerated Xenon Arc Exposure (Visual 100-1000 AFU)



**SDN**  
**Exposed**  

---

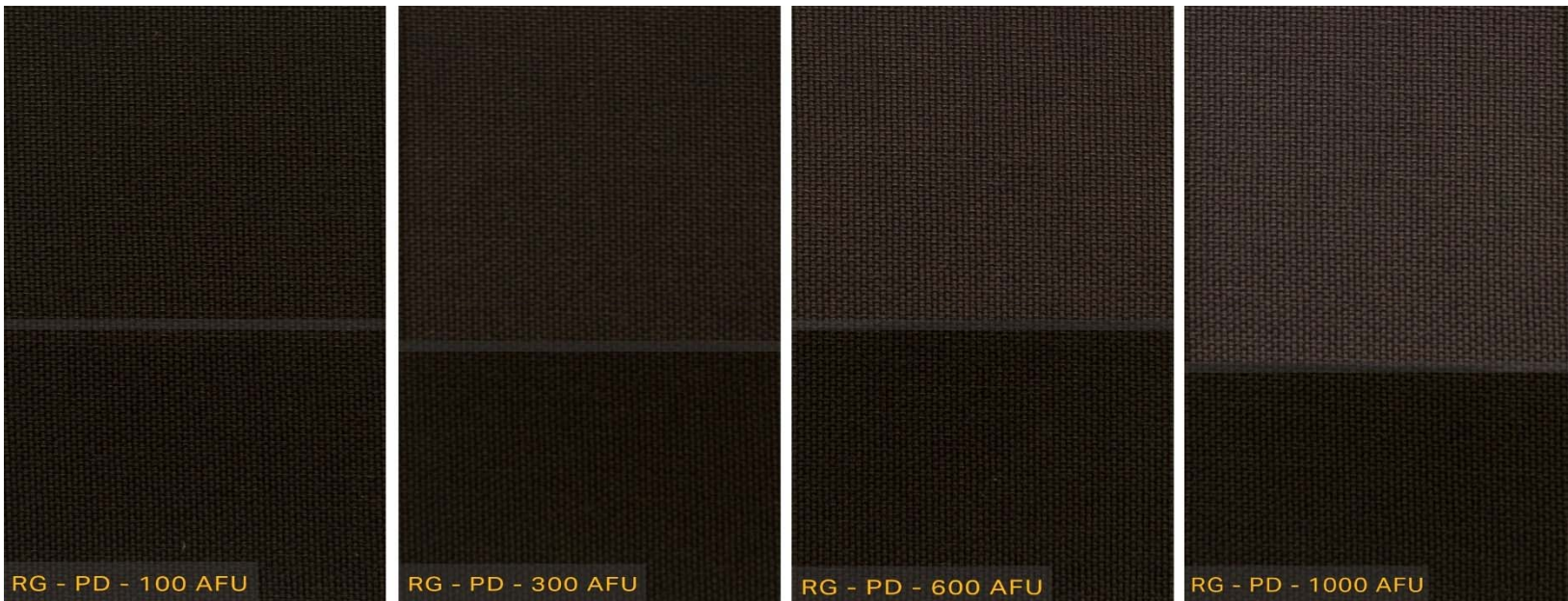
**SDN**  
**Covered**



**Piece Dye**  
**Exposed**  

---

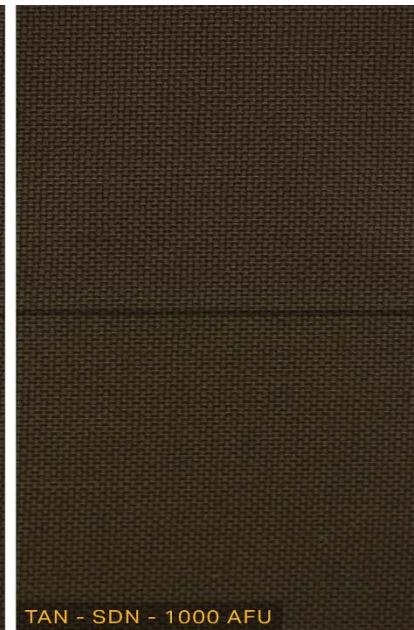
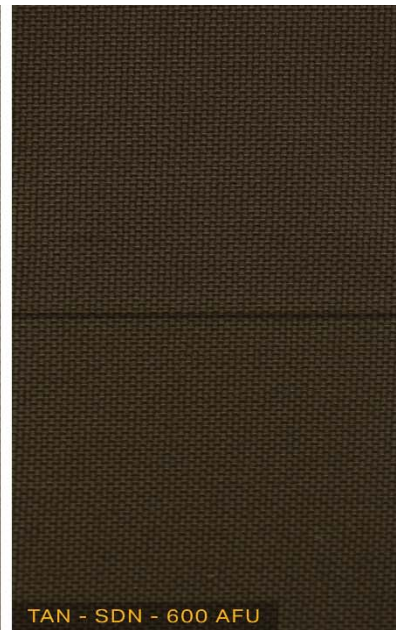
**Piece Dye**  
**Covered**



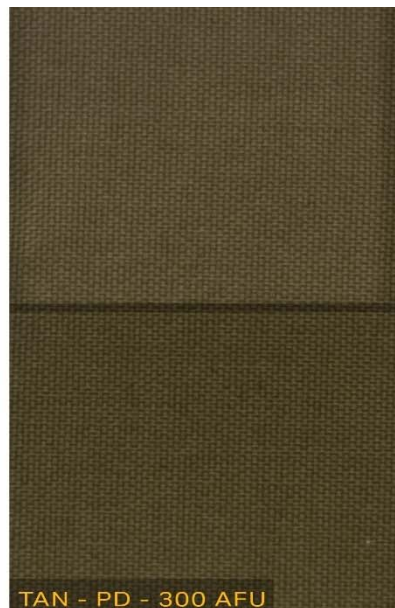
# Tan 499-Accelerated Xenon Arc Exposure (Visual 100-1000 AFU)



SDN  
Exposed  
-----  
SDN  
Covered



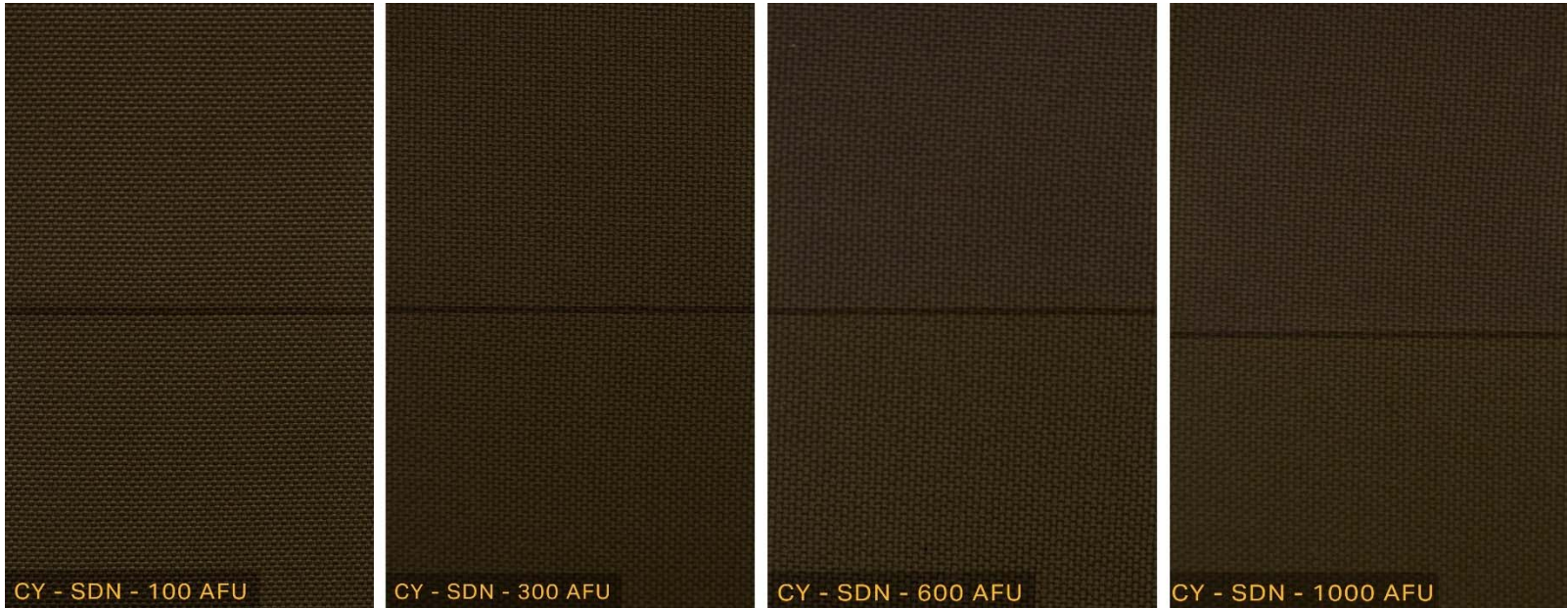
Piece Dye  
Exposed  
-----  
Piece Dye  
Covered



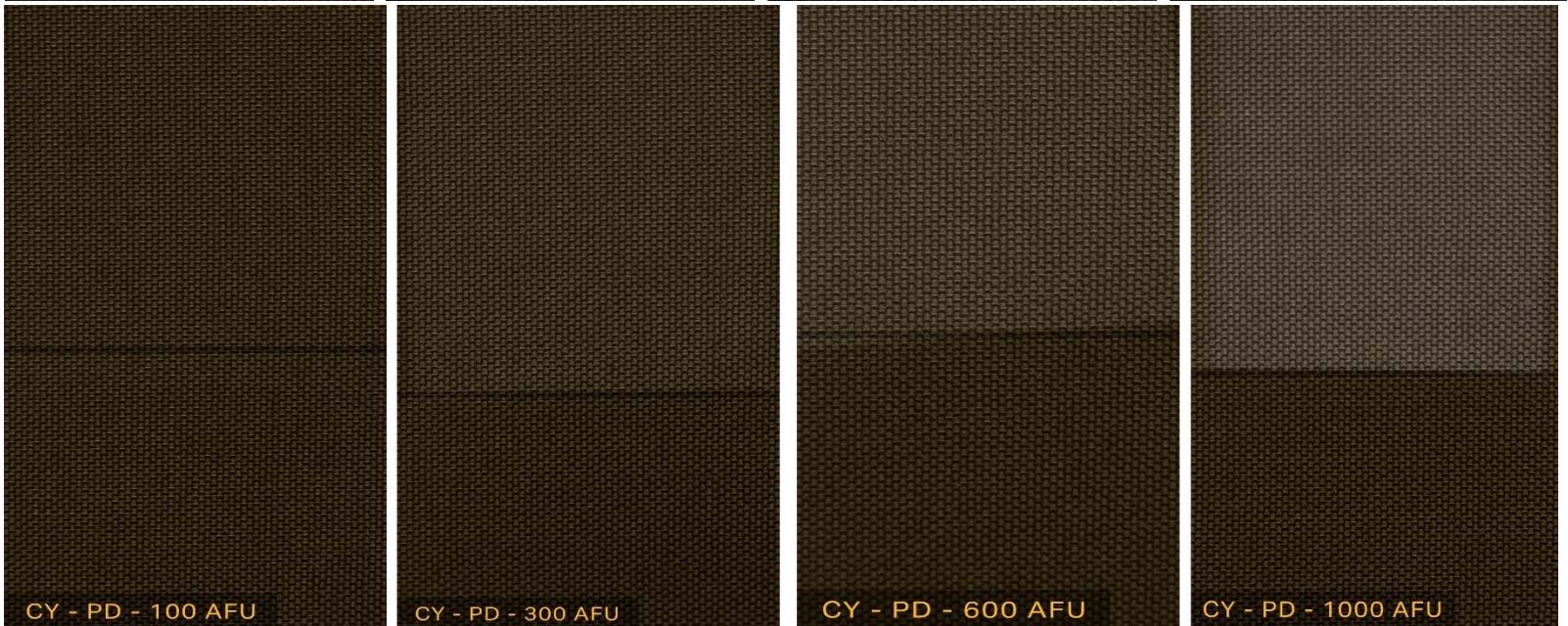
# Coyote 498-Accelerated Xenon Arc Exposure (Visual 100-1000 AFU)



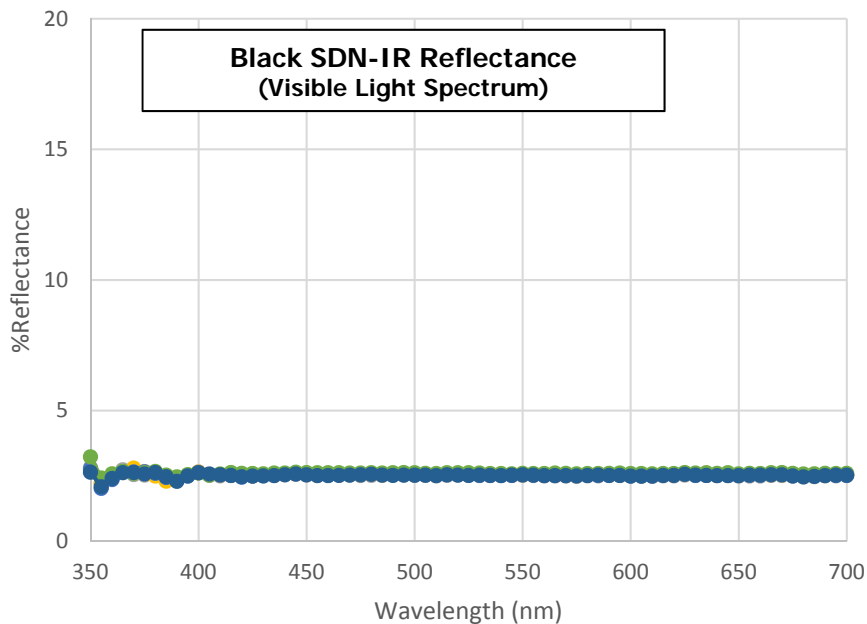
**SDN**  
**Exposed**  
-----  
**SDN**  
**Covered**



**Piece Dye**  
**Exposed**  
-----  
**Piece Dye**  
**Covered**

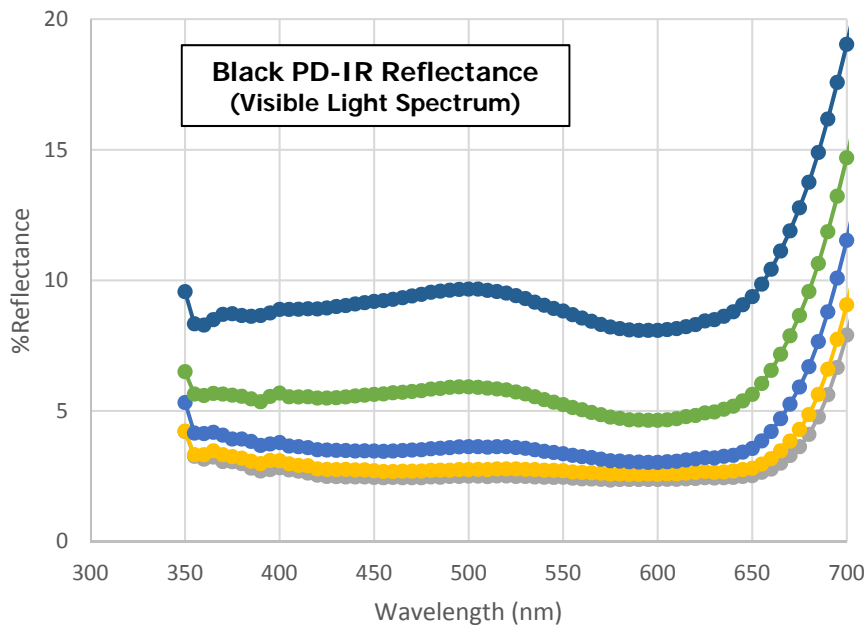


# Black-IR Reflectance after UV exposure (Visible Light)



***SDN CORDURA Maintains IR Signature after exposure to accelerated UV light***

Black SDN maintains color through the Visible Light IR spectrum after accelerated Xenon Arc UV light exposure

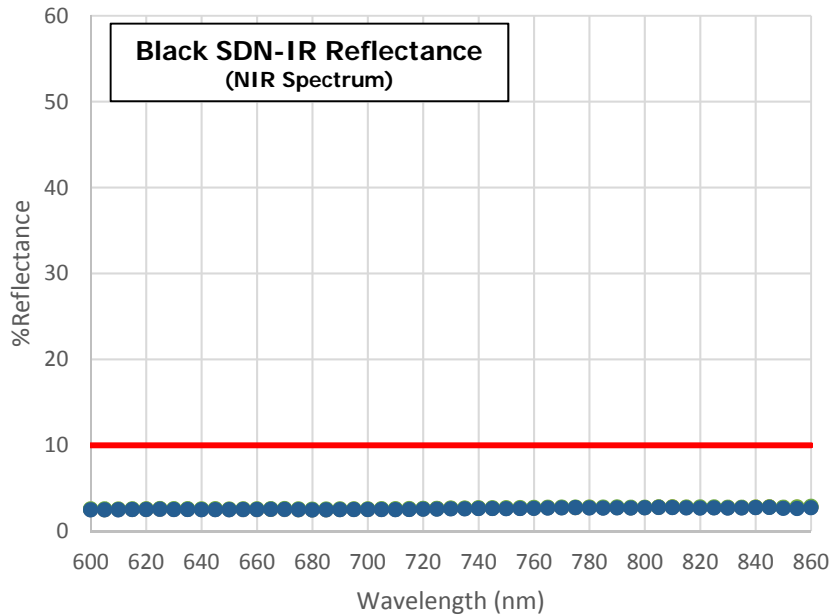


Black Piece Dye loses color through the Visible Light IR spectrum after accelerated Xenon Arc UV light exposure



# Black-IR Reflectance after UV exposure (Near Infrared)

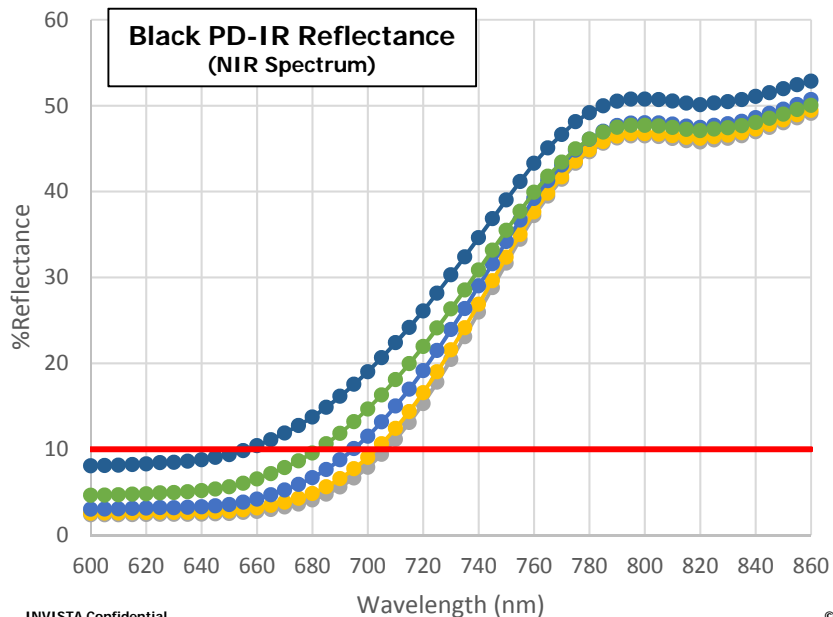
## ***SDN CORDURA Maintains IR Signature after exposure to accelerated UV light***



- BK SDN Control
- BK SDN 100 AFU
- BK SDN 300 AFU
- BK SDN 600 AFU
- BK SDN 1000 AFU
- BK Max IR

\*US MIL Spec Max IR Requirement

*Black SDN meets the min/max NIR requirements through the Near Infrared (NIR) spectrum before and after accelerated Xenon Arc UV light exposure.*



- BK PD Control
- BK PD 100 AFU
- BK PD 300 AFU
- BK PD 600 AFU
- BK SDN 1000 AFU
- BK Max IR

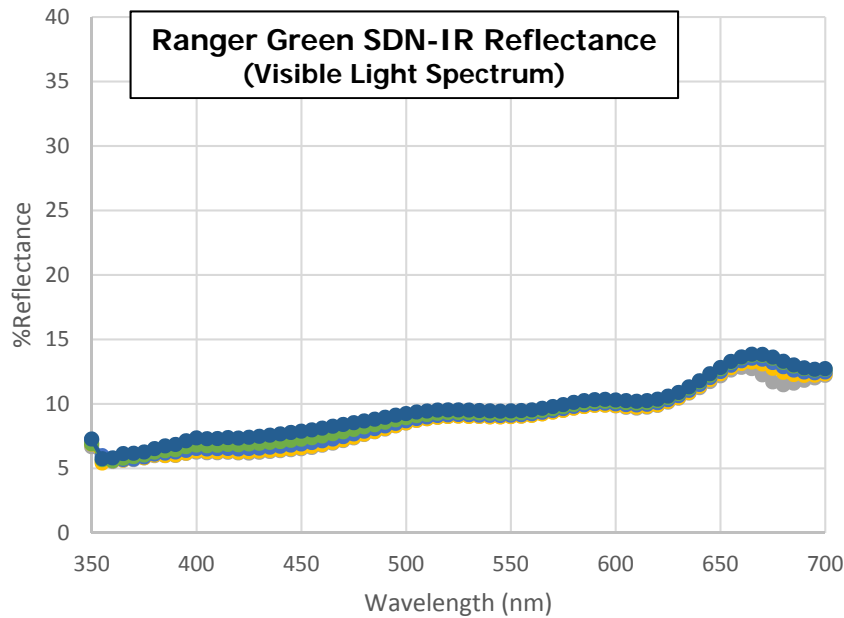
\*US MIL Spec Max IR Requirement

Black Piece Dye does not meet the min/max NIR requirements through the Near Infrared (NIR) spectrum before or after accelerated Xenon Arc UV light exposure.

# Ranger Green-IR Reflectance after UV exposure (Visible Light)

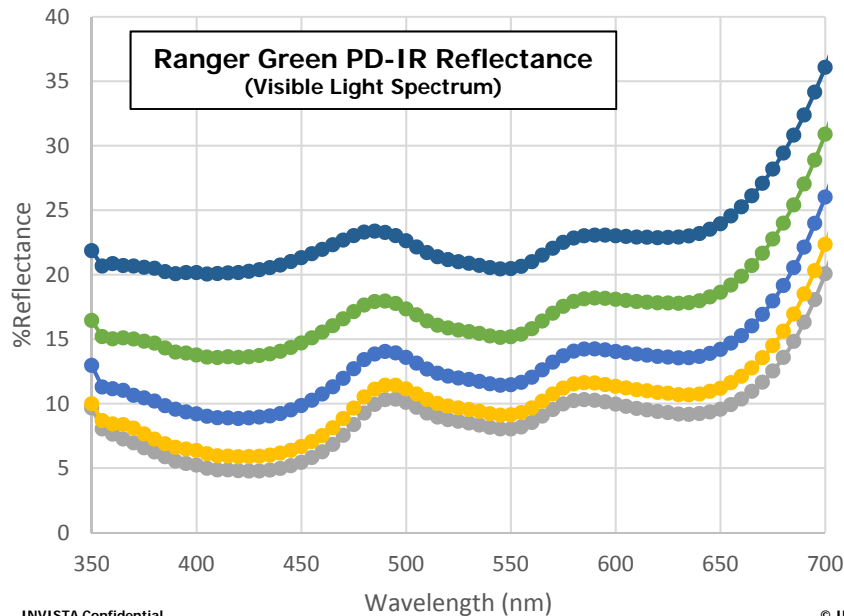


## *SDN CORDURA Maintains IR Signature after exposure to accelerated UV light*



- GG SDN Control
- GG SDN 100 AFU
- GG SDN 300 AFU
- GG SDN 600 AFU
- GG SDN 1000 AFU

Ranger Green SDN maintains color through the Visible Light IR spectrum after accelerated Xenon Arc UV light exposure.

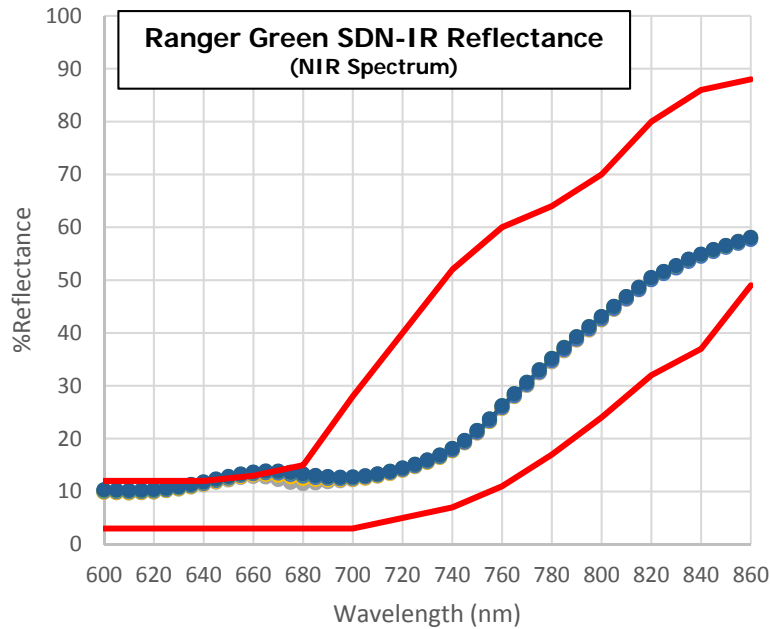


- GG PD Control
- GG PD 100 AFU
- GG PD 300 AFU
- GG PD 600 AFU
- GG SDN 1000 AFU

Ranger Green Piece Dye loses color through the Visible Light IR spectrum after accelerated Xenon Arc UV light exposure.

# Ranger Green-IR Reflectance after UV exposure (Near Infrared)

## ***SDN CORDURA Maintains IR Signature after exposure to accelerated UV light***

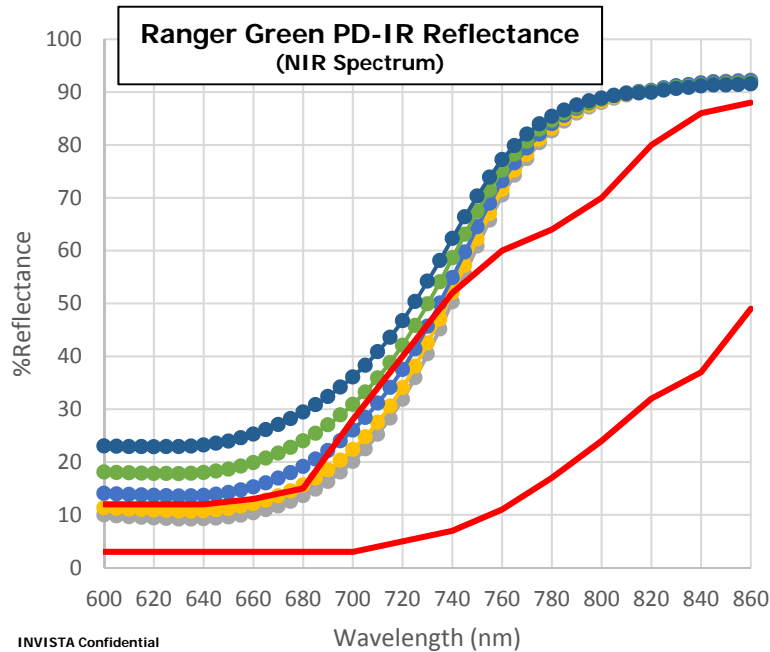


- GG SDN Control
- GG SDN 100 AFU
- GG SDN 300 AFU
- GG SDN 600 AFU
- GG SDN 1000 AFU
- Camo Green Min IR
- Camo Green Max IR

*\*US MIL Spec Min/Max IR Requirement*

*\*No Mil Spec IR requirement for Ranger Green, comparison made to Camo Green*

*Ranger Green SDN meets the min/max NIR requirements through the Near Infrared (NIR) spectrum before and after accelerated Xenon Arc UV light exposure.*



- GG PD Control
- GG PD 100 AFU
- GG PD 300 AFU
- GG PD 600 AFU
- GG SDN 1000 AFU
- Camo Green Min IR
- Camo Green Max IR

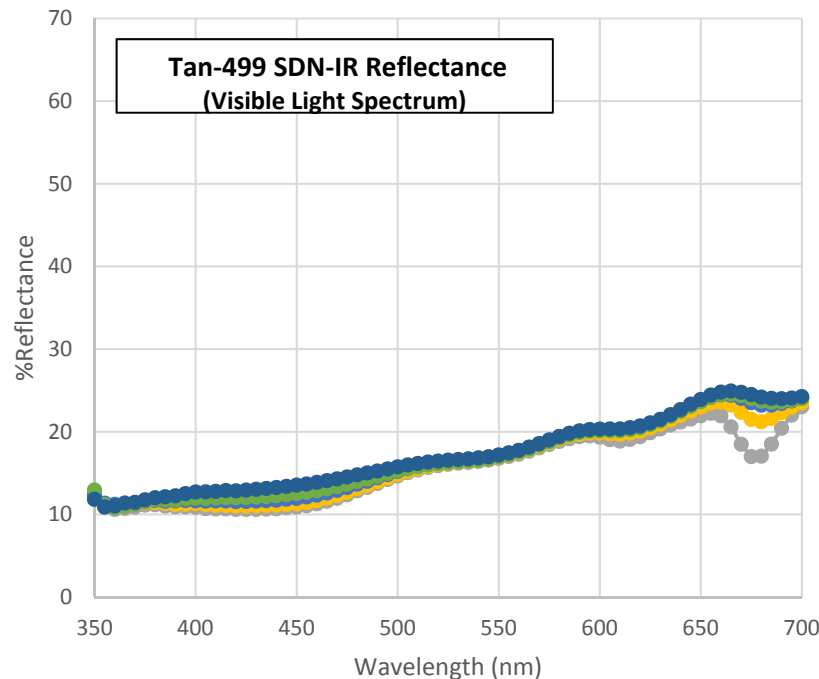
*\*US MIL Spec Min/Max IR Requirement*

*\*No Mil Spec IR requirement for Ranger Green, comparison made to Camo Green*

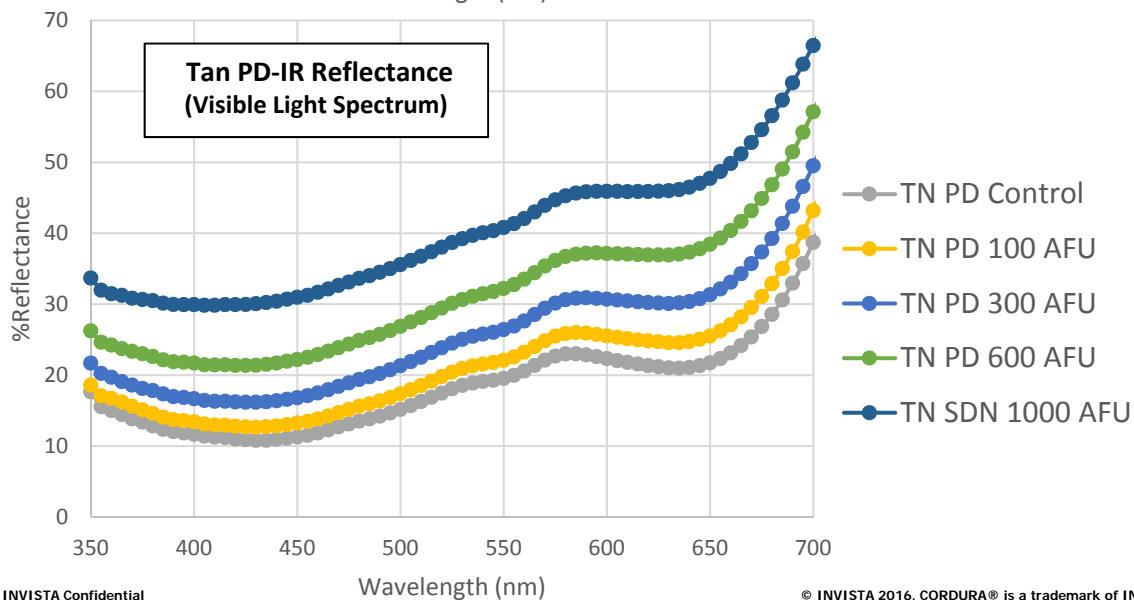
*Ranger Green Piece Dye does not meet the min/max NIR requirements through the Near Infrared (NIR) spectrum before or after accelerated Xenon Arc UV light exposure.*

# Tan 499-IR Reflectance after UV exposure (Visible Light)

## *SDN CORDURA Maintains IR Signature after exposure to accelerated UV light*



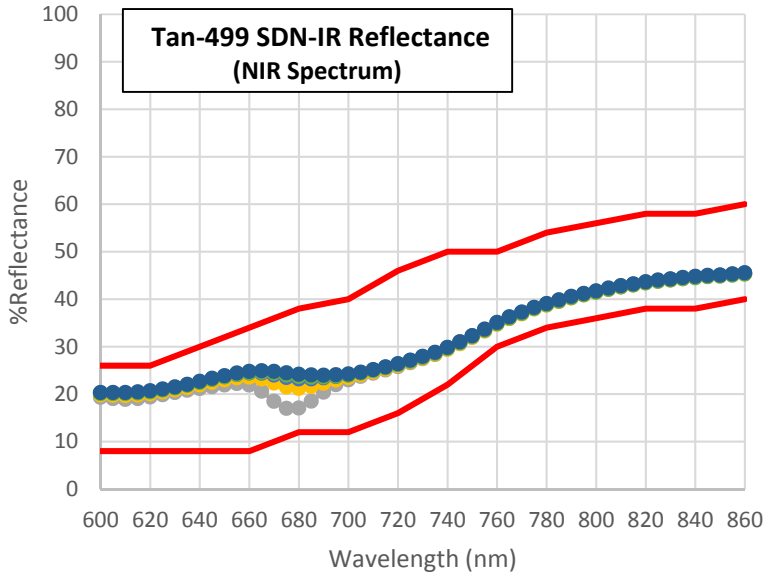
Tan-499 SDN maintains color through the Visible Light IR spectrum after accelerated Xenon Arc UV light exposure.



Tan Piece Dye loses color through the Visible Light IR spectrum after accelerated Xenon Arc UV light exposure.

# Tan 499-IR Reflectance after UV exposure (Near Infrared)

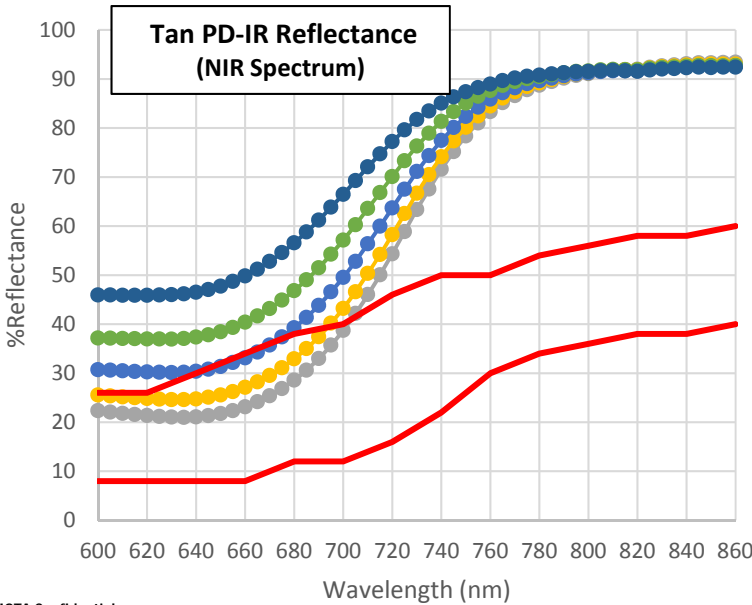
## *SDN CORDURA Maintains IR Signature after exposure to accelerated UV light*



- TN SDN Control
- TN SDN 100 AFU
- TN SDN 300 AFU
- TN SDN 600 AFU
- TN SDN 1000 AFU
- TN Min IR
- TN Max IR

Tan-499 SDN meets the min/max NIR requirements through the Near Infrared (NIR) spectrum before and after accelerated Xenon Arc UV light exposure.

*\*US MIL Spec Min/Max IR Requirement*



- TN PD Control
- TN PD 100 AFU
- TN PD 300 AFU
- TN PD 600 AFU
- TN SDN 1000 AFU
- TN Min IR
- TN Max IR

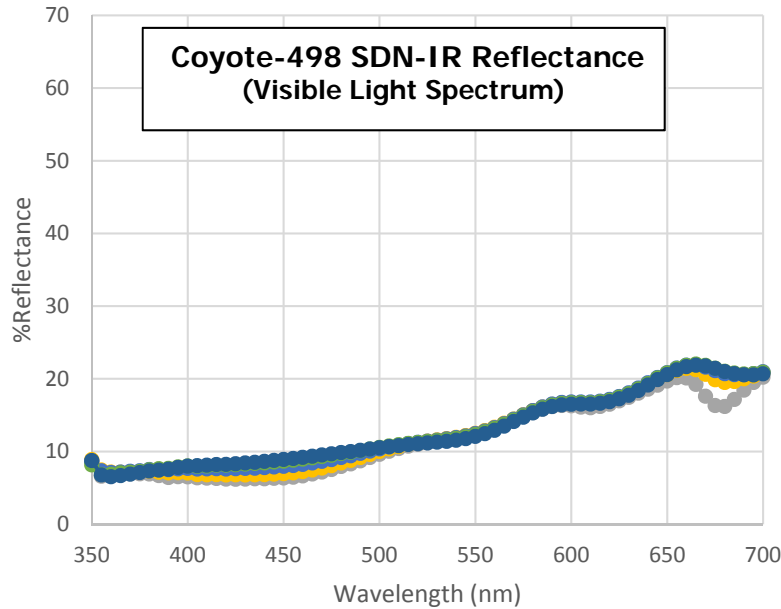
Tan Piece Dye does not meet the min/max NIR requirements through the Near Infrared (NIR) spectrum before or after accelerated Xenon Arc UV light exposure.

*\*US MIL Spec Min/Max IR Requirement*

# Coyote 498-IR Reflectance after UV exposure (Visible Light)

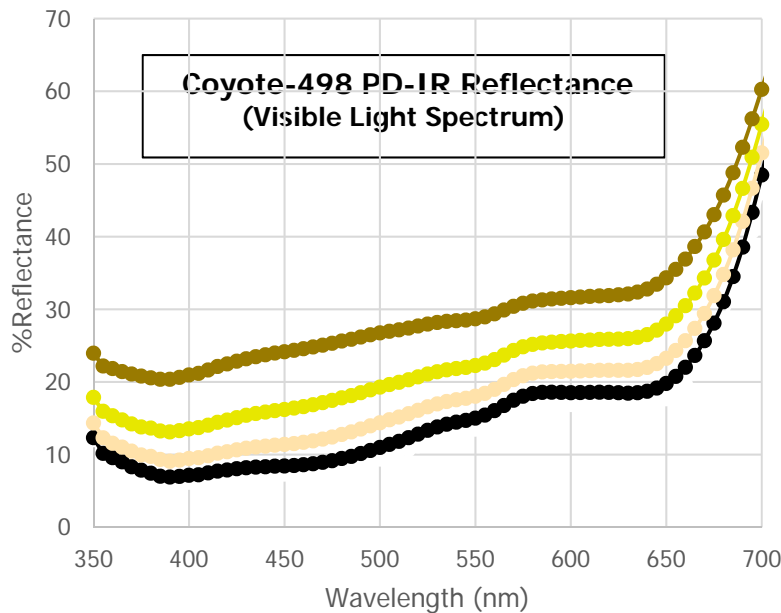


## ***SDN CORDURA Maintains IR Signature after exposure to accelerated UV light***



- CY SDN Control
- CY SDN 100 AFU
- CY SDN 300 AFU
- CY SDN 600 AFU
- CY SDN 1000 AFU

Coyote-498 SDN maintains color through the Visible Light IR spectrum after accelerated Xenon Arc UV light exposure.



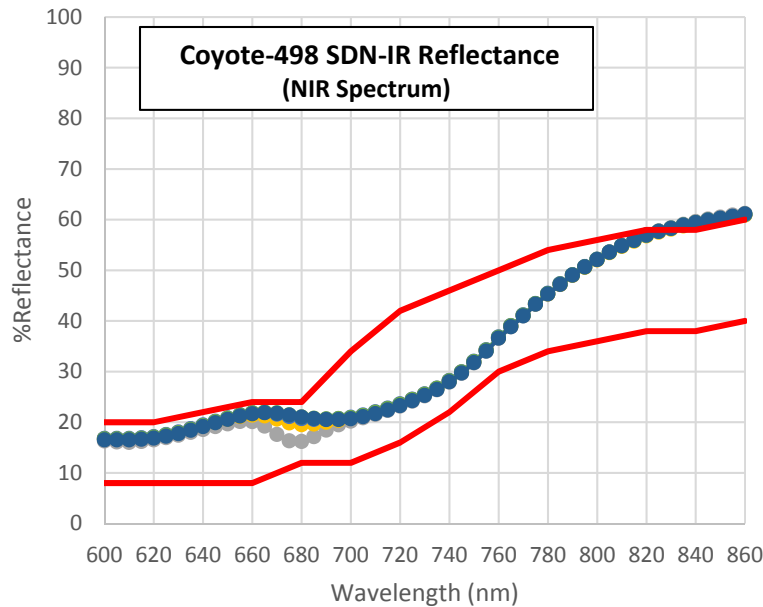
- CY PD Control
- CY PD 100 AFU
- CY PD 300 AFU
- CY PD 600 AFU
- CY PD 1000 AFU

Coyote Piece Dye loses color through the Visible Light IR spectrum after accelerated Xenon Arc UV light exposure.

# Coyote 498-IR Reflectance after UV exposure (Near Infrared)



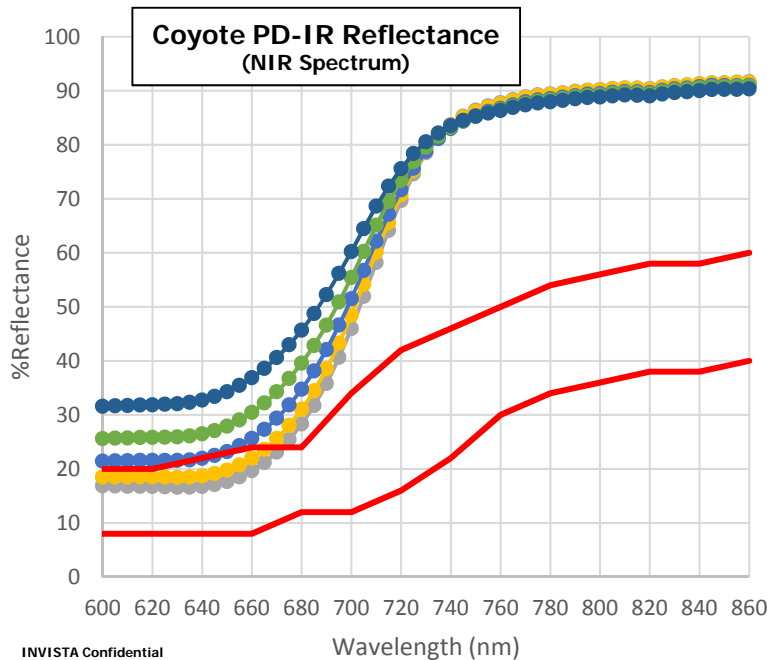
## ***SDN CORDURA Maintains IR Signature after exposure to accelerated UV light***



- CY SDN Control
- CY SDN 100 AFU
- CY SDN 300 AFU
- CY SDN 600 AFU
- CY SDN 1000 AFU
- CY Min IR
- CY Max IR

*\*US MIL Spec Min/Max IR Requirement*

Coyote-498 SDN meets the min/max NIR requirements through the Near Infrared (NIR) spectrum before and after accelerated Xenon Arc UV light exposure.



- CY PD Control
- CY PD 100 AFU
- CY PD 300 AFU
- CY PD 600 AFU
- CY PD 1000 AFU
- CY Min IR
- CY Max IR

*\*US MIL Spec Min/Max IR Requirement*

Coyote Piece Dye does not meet the min/max NIR requirements through the Near Infrared (NIR) spectrum before or after accelerated Xenon Arc UV light exposure.

# Life Cycle Analysis-Solution Dye vs Piece Dye Coloration



## *Potential Energy, Water and CO2 Savings with SDN Fabric processing*

<b>Fabric Processed Meters</b>	<b>Water Savings Liters</b>	<b>Yearly Drinking water Number of People</b>	<b>Olympic Size Pools Number filled</b>
1	1.87	0	0
250,000	467,732	493	0.20
500,000	935,464	986	0.39
750,000	1,403,197	1,479	0.59
1,000,000	1,870,929	1,971	0.78

<b>Fabric Processed Meters</b>	<b>Energy Savings Mj's</b>	<b>Average Yearly Power Number of Households</b>	<b>Power a 60 watt light bulb-Number of years</b>
1	1.63	0	0
250,000	408,047	10.6	216
500,000	816,094	21.3	431
750,000	1,224,141	31.9	647
1,000,000	1,632,188	42.6	863

<b>Fabric Processed Meters</b>	<b>Avoided CO2 Emmission Kg's</b>	<b>Equivalent to Driving a Car for Years</b>	<b>Equivalent Car Trips Around the World</b>
1	0.11	0	0
250,000	26,845	4.9	2.3
500,000	53,690	9.8	4.7
750,000	80,534	14.7	7.0
1,000,000	107,379	19.7	9.4

*\* Data based on the average of 3 dyeing and finishing mills in China, Taiwan and Korea and collected 1Q13*