Transitions® XTRActive®

A PHOTOCHROMIC DYE CHEMIST'S CHALLENGE:

USING SCIENCE TO CREATE A PHOTOCHROMIC LENS THAT OFFERS EXTRA PROTECTION FROM LIGHT OUTDOORS, INDOORS AND EVEN IN THE CAR

A QUICK LOOK AT TRANSITIONS® XTRActive® LENSES

SUPERIOR DARKNESS
OUTDOORS

Uniquely designed for extra light protection, even in the brightest sunlight and the hottest conditions.

ACTIVATION
BEHIND WINDSHIELD

Achieves up to category 2 darkness behind the windshield to protect eyes from sunlight while driving.[1]

HINT OF TINT
INDOORS

A hint of tint helps protect eyes from harsh indoor lighting, helping to reduce eye strain and fatigue.

Transitions XTRActive lenses offer unique capabilities - extra protection from light outdoors, indoors and even in the car. These key performance attributes are linked to one basic principle: taking advantage of the lower wavelengths of the visible spectrum and their increased irradiance*.

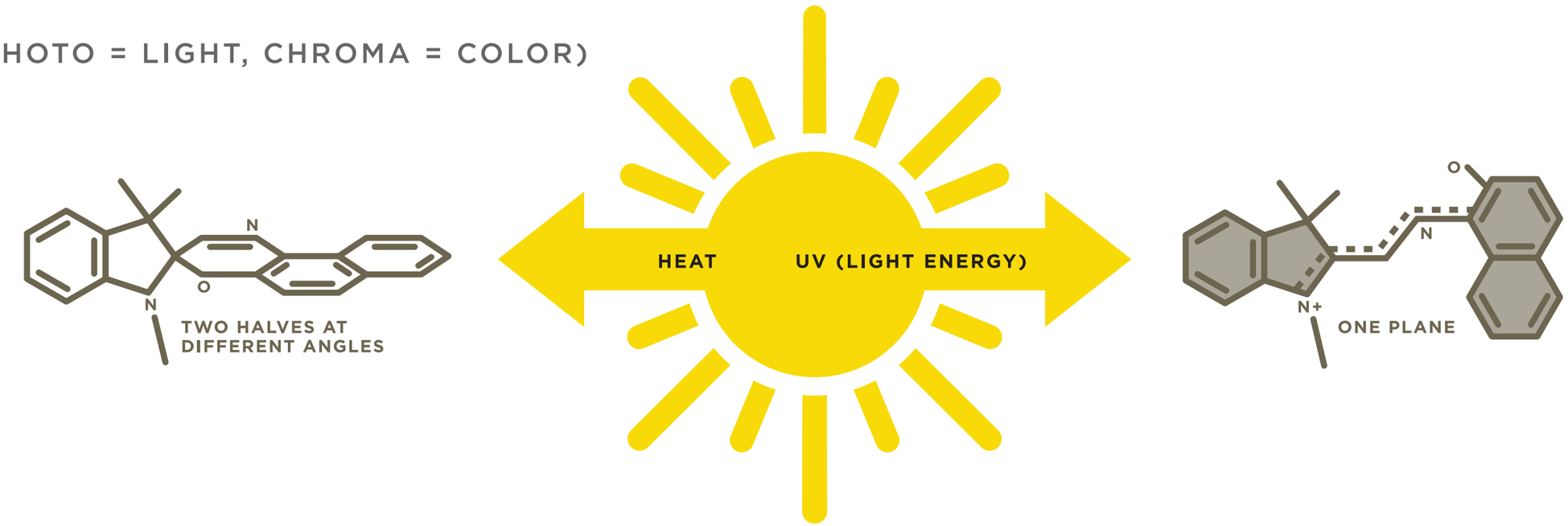
FOR PATIENTS WHO

- Spend more time outdoors. and in the car
- Are light sensitive or especially concerned about eye health
- Interested in products with increased functionality

*See glossary.

A QUICK LOOK AT PHOTOCHROMICS

(PHOTO = LIGHT, CHROMA = COLOR)



Photochromic technology has been a core competency at Transitions Optical for more than 25 years. The definition of photochromics is a light-induced, reversible change in color. A photochromic lens contains millions of photochromic molecules.

In the **colorless state,** these molecules consist of two smaller chromophores (or halves) held out of plane from one another (at different angles). Or, in other words, when the lenses are clear, the two halves of the photochromic molecule are perpendicular to each other.

When **exposed to light energy,** a chemical bond breaks and the molecule rearranges itself from two smaller chromophores into one large chromophore (or one flat plane) that absorbs in both the UV and the visible portion of the electromagnetic (EM) light spectrum.

This means the molecule now has color. Simply put, the UV light changes the shape of the photochromic molecules and the lenses darken. When the light **energy is taken away,** heat reforms the bond, and the lenses go back to clear.

Because the fade back reaction is driven by heat, when it is very hot outside the photochromic molecules are pushed back to their clear state even as UV light energy is driving them to activate. This is why the performance of all photochromic lenses are influenced by temperature.

To overcome this challenge, Transitions® XTRActive® lenses use a different formulation of photochromic dyes. *Transitions XTRActive* lenses feature a broad spectrum dye specially designed to react to both UV and visible light for extra darkness outdoors, even in the car. These special molecules collect “extra” energy enabling the lens to darken more, even in the hottest climates.

BEHIND THE TECHNOLOGY

The Transitions Optical Research and Development team specifically targeted visible light activation when developing *Transitions XTRActive* lenses.

Transitions XTRActive lenses use Transitions Optical's patented advanced photochromic technology, but are designed with a different formulation (or blend) of photochromic dyes, which are "tuned" to not only activate in the UV region, but also in the visible region of the spectrum. This unique feature gives patients the benefit of extra protection from light and a superior visual experience.

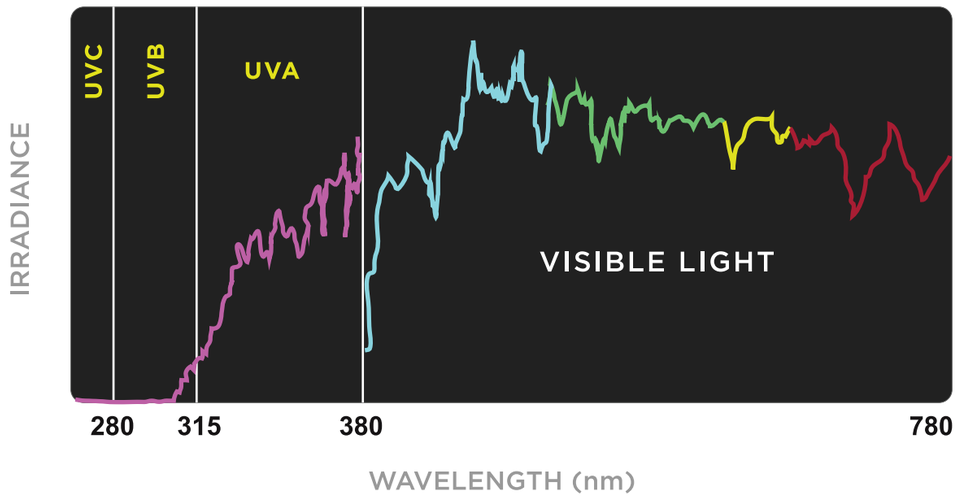
Transitions Life360™

Transitions Optical develops photochromic lenses using a proprietary measurement methodology designed to look at the experience of wearers in real world conditions, real locations and real situations. Life360™ includes three types of measurements:

Traditional:**Laboratory Measurements -** These take place in a controlled lab environment using a specially designed optical bench and are representative of optimal conditions (lenses perpendicular to the sun, controlled temperature and light exposure). Lab testing provides baseline measurements, but these measurements are only part of the story.

Using real people, in real life conditions, products are validated using **Live Wearer Testing.** This blind testing reflects what wearers are actually experiencing with the lenses.

Finally, Transitions Optical has evolved the way photochromics are tested to capture **Real World Measurements.** Real world measurements means exactly that. Products are taken out into the world and the performance is quantified in the many hundreds of different real life conditions. Representing more than a thousand scenarios - combining temperatures, angles of light, UV, weather conditions, time of day, time of year and geographics to reflect how products perform in all situations.



WITHIN THE TYPICAL SUNLIGHT SPECTRUM...

- The visible light range is the portion that allows the eye to see color.
- The UV region, particularly the UVA portion, is the energy range that causes the chemical reaction in photochromic lenses.

SHIFTING INTO THE VISIBLE REGION

If we look at the absorbance* of the dyes used in *Transitions* lenses, these dyes in their colorless form cease to absorb beyond ~410nm. In contrast, the dyes used in *Transitions XTRActive* lenses absorb visible light, out to ~430nm.

The outdoor solar irradiance spectrum has an approximately two-fold increase in intensity at ~400nm vs. ~390nm. Because the absorbance spectra of the *Transitions XTRActive* lens permits this energy to be absorbed and the photochromic rearrangement reaction to occur, the lens is able to darken more as it captures a larger quanta of energy when compared with the *Transitions Signature* VII lens that has less absorbance in this same region of the EM spectrum.

THREE WAYS THIS UNIQUE FORMULA DELIVERS BENEFIT TO YOUR PATIENTS:

1. Designed for extra protection from light, even in the brightest sun and hottest conditions.
2. A hint of tint helps protect eyes from harsh indoor lighting, helping to reduce eye strain and fatigue.
3. Achieves up to category 2 darkness behind the windshield to protect eyes from sunlight while driving.[1]

*See glossary.

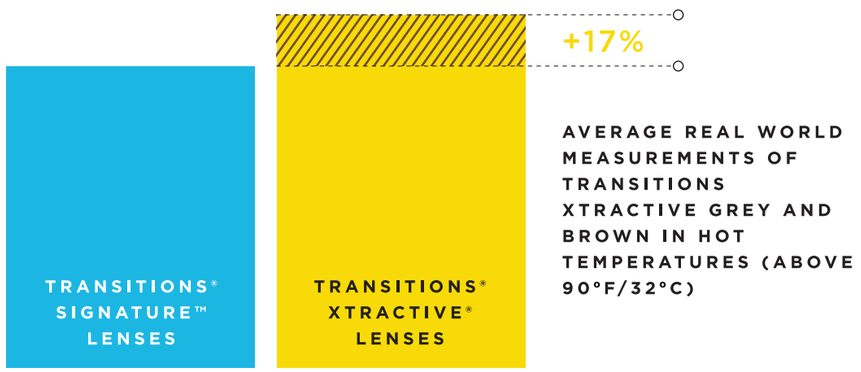
MORE ACTIVATION: DARKER FOR EXTRA LIGHT PROTECTION OUTDOORS

As with all photochromic technology, *Transitions XTRActive* lenses are influenced by temperature. This is because heat reforms the chemical bond of photochromic molecules - hot temperatures drive the lenses back to clear; and the colder the temperature, the darker the lenses will get. This temperature factor has been minimized in *Transitions XTRActive* lenses.

The visible light activation allows *Transitions XTRActive* lenses to become even darker in both average temperatures and in hot temperatures than traditional photochromic lenses.

Life360 data shows that *Transitions XTRActive* lenses in both gray and brown are darker than *Transitions Signature* VII lenses. Live wearer testing shows that 4 out of 5 wearers are satisfied with the level of darkness outdoors. [2]

DARKER IN HOT CLIMATES[1]
AVERAGE DARKNESS IN 90°F/32°C



4 OUT OF 5 WEARERS ARE SATISFIED WITH THE LEVEL OF DARKNESS OUTDOORS.

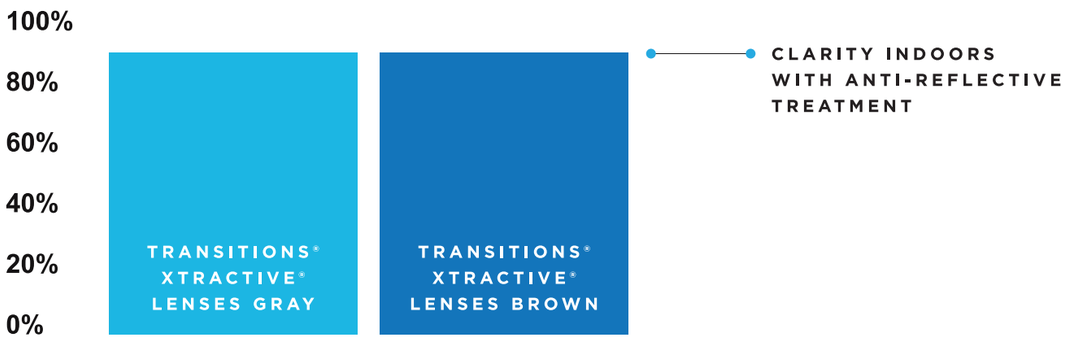
A HINT OF TINT INDOORS

In their clearest state indoors, *Transitions XTRActive* lenses are designed to have a hint of tint to help protect from harsh indoor lighting, helping to reduce eyestrain and fatigue. In live wearer testing[2] - less than 3 out of 5 wearers perceived that the lenses had an indoor tint. In fact, 3 out of 4 wearers[2] are satisfied or very satisfied with the level of indoor clarity.

Transitions XTRActive lenses provide a good level of clarity indoors. Indoors, the lenses are not activated; the energy from normal indoor lighting isn't strong enough to activate the lenses. At their clearest state indoors and with an anti-reflective coating, the lenses have an average indoor light transmission of 90%.[1]

3 OUT OF 4 WEARERS ARE SATISFIED WITH INDOOR CLARITY

HINT OF TINT GOOD FOR INDOOR USE[1]



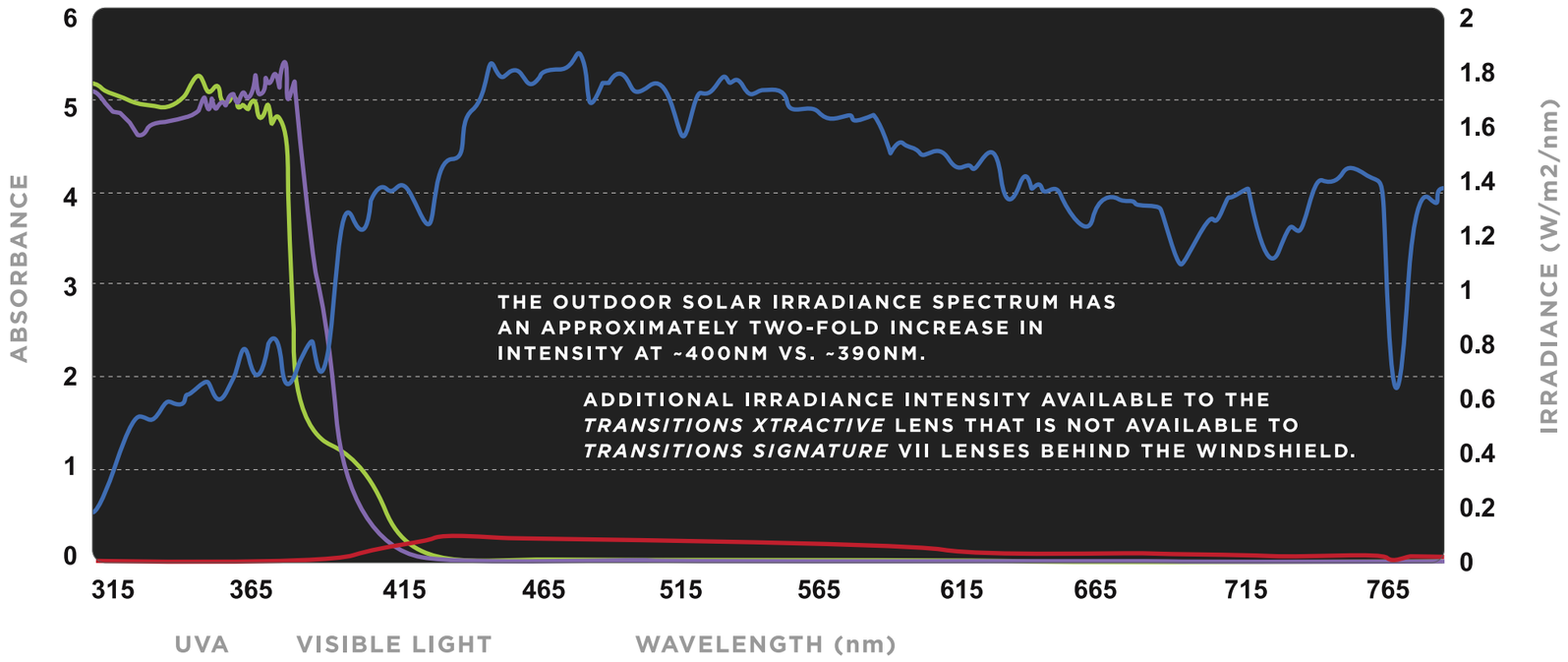
ACTIVATION BEHIND THE WINDSHIELD

Today's windshields have UV absorbers to protect the dashboard and interior of a vehicle from the damaging effects of high energy UV rays, resulting in a cutoff of available irradiance intensity below ~400nm.

Additionally, the roof of a vehicle substantially reduces the available irradience intensity reaching the driver opposed to the intensity present outside in full sunlight.

For these reasons, *Transitions Signature* VII lenses don't offer significant darkness in the car. However, the absorbance spectrum (or, the visible light activation) of the *Transitions XTRActive* lens permits a larger quantum of energy to be absorbed and makes it possible for the lens to darken and activate behind the windshield of a car during the day. In car activation is dependent on temperature, driver position, windshield and lateral window transmission properties.

TRANSITIONS® XTRACTIVE® LENSES **VS.** TRANSITIONS® SIGNATURE™ VII LENSES



OUTDOOR SOLAR IRRADIANCE
***TRANSITIONS SIGNATURE* VII LENS ABSORBANCE**
***TRANSITIONS XTRACTIVE* LENS ABSORBANCE**
IRRADIANCE AT NORMAL DRIVING POSITION

- **The Blue line** shows the outdoor solar irradiance spectrum (or, the sun's intensity outside of the car). Note the spike of increased intensity available at ~400nm vs. ~390nm.
- **The Purple line** shows the energy/irradiance that *Transitions Signature* VII absorbs - you can see the lenses have high absorption in the UV range and decrease in absorption to transmit visible light.
- **The Green line** shows the energy/irradiance that *Transitions XTRActive* absorbs. Note how the dyes used in *Transitions XTRActive* lenses absorb out to ~430nm (not only in UV but also in the visible part of the spectrum). This extra absorbance enables the lenses to darken even in the hottest climates and behind the windshield - because the lenses capture more energy.
- **The Red line** shows the sun's intensity inside the car in a normal driving position. Note how the UV component is completely eliminated by the windshield glass.

4 OUT OF 5 WEARERS ARE SATISFIED WITH *TRANSITIONS XTRActive* LENSES WHEN DRIVING IN SUNNY CONDITIONS[2]

In spite of these excellent wearer results, *Transitions XTRActive* lenses are not a replacement for sunglasses - especially polarized sunglasses which block blinding glare (bright sunlight reflected off surfaces such as the road). They will, however, benefit patients more than a clear lens would in the car.

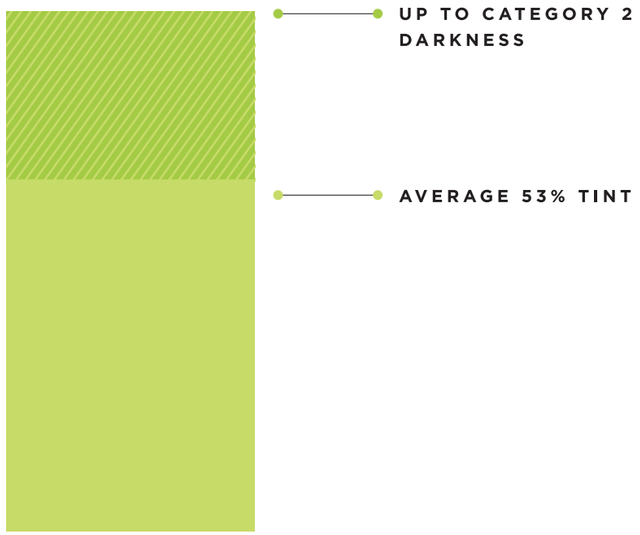
9 OUT OF 10 EYECARE PROFESSIONALS AGREE[3]

- even though *Transitions XTRActive* lenses don't block blinding glare behind the windshield - they would still benefit patients more than a clear lens would in the car.

DARKNESS BEHIND THE WINDSHIELD

AVERAGE OF REAL WORLD MEASUREMENTS WHEN DRIVING[1]

Real world measurements show that *Transitions XTRActive* lenses reach an average darkness of 53% tint in the car. The performance of *Transitions XTRActive* lenses behind the windshield may be influenced by a variety of factors, including temperature, the position of the driver in the car, the shape and inclination of the windshield and characteristics of the glass used to manufacture the windshield. Depending on these conditions, *Transitions XTRActive* lenses can achieve up to category 2 darkness behind the windshield to protect eyes from sunlight while driving. Because *Transitions XTRActive* lenses were developed to take advantage of the lower wavelengths of the visible spectrum they are able to achieve what other photochromics do not.



YOUR **OPPORTUNITY**

Transitions XTRActive lenses offer patients extra protection from light indoors, outdoors and even in the car. Anywhere they go, *Transitions XTRActive* lenses are always working to protect your patients' eyes from the brightest sun and harsh artificial light. *Transitions XTRActive* lenses provide unique benefits that can help you satisfy more of your patients' needs.

3 OUT OF 4 EYECARE PROFESSIONALS AGREE[3]

Transitions XTRActive lenses are a great option for patients new to the photochromic category.

*GLOSSARY

(IN ORDER OF APPEARANCE)

Irradiance: Irradiance - or light energy from the sun - is the power of electromagnetic radiation per unit area incident on a surface. It is measured in W / m^2.

Absorbance: The absorbance (also called optical density) of a material is a logarithmic ratio of the radiation falling upon a material, to the radiation transmitted through a material. It is unitless.

SOURCES

[1] Transitions Optical, Inc. Real World Measurements, (2012 - 2013)

[2] Double blind wearers tests conducted in Brazil (Expertise, 2014), Spain (Ifop, 2014), and US (Pinnacle Marketing, 2009)

[3] Transitions XTRActive lenses Eyecare Professional Claims Study conducted in France (MSW-ARS, 2014)

EQUIVALENCE TABLE BETWEEN ABSORBANCE AND TRANSMISSION

ABSORBANCE	TRANSMISSION
0	100%
0.1	79%
0.25	56%
0.5	32%
0.75	18%
1	10%
2	1%
3	0.1%

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