



# Glare Control and ASTM E2141: Requirements for Lasting Performance

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# Electrochromic Durability: Building a Lasting Experience

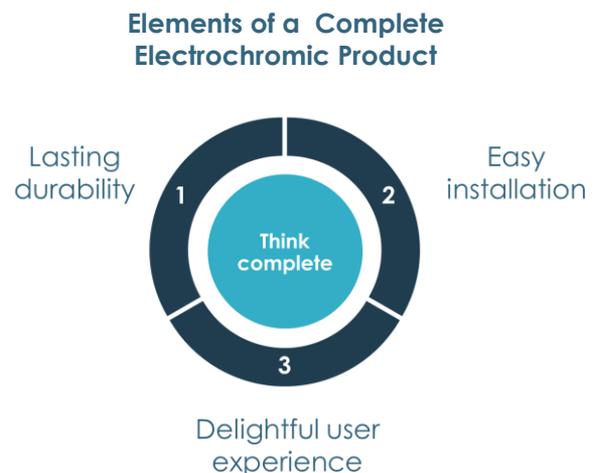
Achieving lasting glare and heat control leaves  
no room for performance degradation

Great products developed with durability in mind continue to delight customers for years. Electrochromic windows are designed to **control glare and heat** while maintaining **access to daylight** and **outside views**. To continue to delight customers with these benefits over the life of the building, **lasting performance is crucial**. In other words, **durability must be at the core** of any smart window system.

Windows are exposed to elements, which can affect the performance of smart window systems. High temperatures, humidity, and ultraviolet light all have the potential to degrade the electrochromic coating. At View, we envisioned a **complete product** based on a **durable electrochromic coating** that's **easy to install** and outlasts the elements for an experience **that delights occupants** over the life of the building.

## View Dynamic Glass: Designed for durability

- ✓ A **complete product** designed with **durability at the core** for a delightful, lasting occupant experience
- ✓ An electrochromic coating constructed from **inorganic, solid state materials** for reliable performance over time **without interruption** from external factors
- ✓ Exceeding the industry standard for electrochromic performance and durability (ASTM E 2141) with **zero degradation**



## Performance you can trust

View has been manufacturing smart glass and providing related services for ten consecutive years. Our electrochromic windows are installed in **over 50 million square feet** of building space with installs ranging Anchorage, Alaska to Kuwait City, Kuwait.

# ASTM Standards and Electrochromic Glass

## ASTM E 2141: Setting electrochromic glass apart



The [American Society for Testing and Materials](#) (ASTM) and [NGA-GANA](#), the largest trade association serving the architectural glass and metals industry supply chain, co-publish the most widely used and referenced set of standard testing, guides, practices, and specifications that govern the glass and glazing industry. While many standards and test methods govern glazing, the one most relevant to electrochromic smart glass is **ASTM E 2141**.

## ASTM Test Method E 2141: Durability and performance of electrochromic coatings

Electrochromic glass must pass evaluation under **ASTM Test Method E 2141** for durability and performance of the electrochromic coating over time. Third-party testing at the [National Renewable Energy Laboratory](#) (NREL) includes:

- Placing sample insulating glass units (IGUs) in a testing chamber for 50,000+ cycles
- Exposure to rapid but realistic current-voltage cycling
- Accelerated weatherability testing under harsh conditions (1-sun full spectrum UV; high temperature (85° C) and humidity cycling; light soaking)

Passing Criteria: The test requires 75% of test IGUs meet allowable variation to physical appearance, color, and performance related to visible light transmittance (+/- 5%  $T_{vis}$ ).

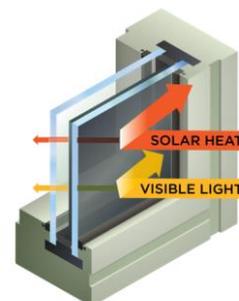


### Durability testing:

Third-party testing conducted at a national laboratory subjects the electrochromic coating to rapid switching, the equivalent of changing tint states two to three times per day, 365 days per year over a 50-year lifetime.

### Electrochromic coatings:

The electrochromic coating allows the glass to switch between clear and tinted states via an electrical stimulus, reducing the amount of glare and heat that reach occupants by reflecting them away from the IGU.

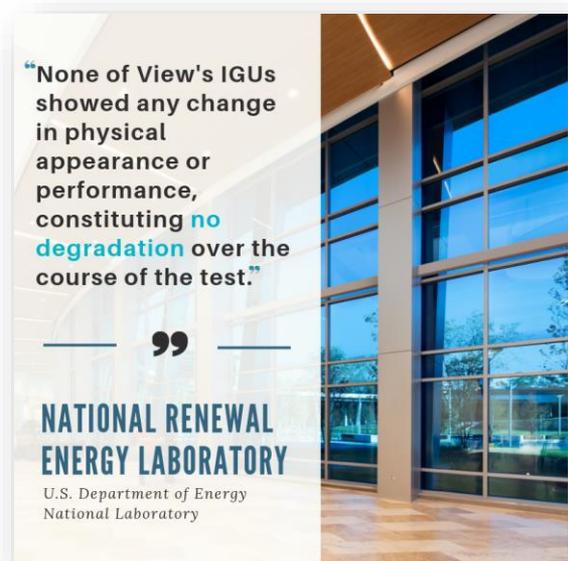


# View IGUs: Durable Glare Control Beyond ASTM E 2141

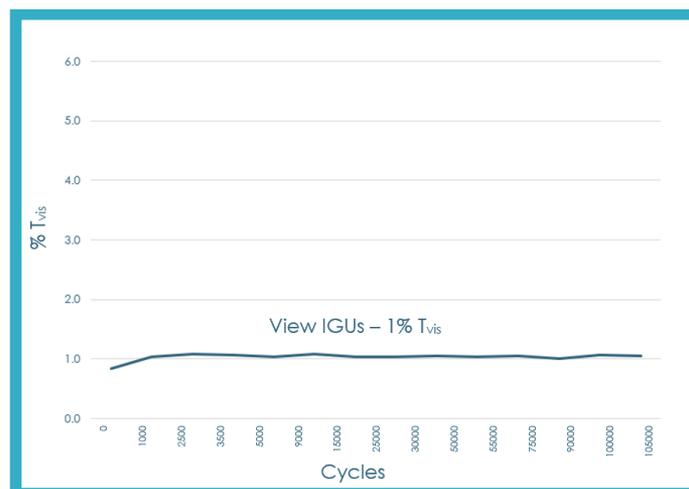
Choosing View Dynamic Glass means windows that perform as well in year 50 as they do in year one

View's electrochromically-coated IGUs were tested by National Renewable Energy Laboratory's and subjected to ASTM E 2141 protocol for weatherability and electrical stimulation over 57,427 cycles (5,044 hours). View IGUs **exceeded ASTM E 2141** with the following results:

- ✓ **100% of test IGUs** passed the test in excellent condition **without any change** to color, transmittance, or performance in both clear and tinted states
- ✓ All test IGUs **entered and exited** the testing chamber with **1%  $T_{vis}$**  - **zero degradation** throughout the test
- ✓ Extended in-house testing to **100,000+ cycles** showed **100% of test IGUs** continued to perform with **no degradation** to performance ( $T_{vis}$ ) or appearance (color) in both clear and tinted states



**View IGU  $T_{vis}$ :**  
No Change or Degradation over 100,000 cycles



# Is ASTM E 2141 Sufficient for Lasting Glare Control?

Maximum glare control and optimal comfort require 1%  $T_{vis}$  or lower that remains stable over time

Based on knowledge gained through installing electrochromic glass in over 50 million square feet of building space, View knows **true glare control** and **occupant comfort** require visible light transmittance of 1%  $T_{vis}$  in the darkest tint state.

Visible light exceeding this 1%  $T_{vis}$  **threshold**, even as low as 1.5% or 2%  $T_{vis}$ , is not sufficient to control for glare under direct sun conditions. It must also **remain stable over time** with **no degradation** because **stable  $T_{vis}$  means lasting comfort** over the 50-year life of the building.

## Understanding ASTM E 2141

Simply meeting ASTM E 2141 requirements **does not guarantee glare control over time** because the Test Method:

1. Does not require IGUs begin at 1%  $T_{vis}$  (glare-control threshold)
2. Allows +/- 5%  $T_{vis}$  degradation over 50,000 cycles
3. Allows a 25% failure rate of IGUs during the test

### Consider the following:

- Without stable  $T_{vis}$ , an IGU that meets ASTM E 2141 could begin testing at 1%  $T_{vis}$  and exit testing at 6%  $T_{vis}$  – well over the glare control threshold
- As  $T_{vis}$  increases over time, occupants will struggle with increasing glare – even 1.5% or 2%  $T_{vis}$  is unacceptable
- Results are even more problematic for occupants when IGUs start at higher  $T_{vis}$  levels



Simply meeting ASTM E 2141 results in a high probability for glare and unsightly window treatments in future years

## Simply meeting ASTM E 2141 isn't enough

A building constructed with electrochromic IGUs that **simply meet ASTM E 2141** can have a **high probability for glare**. For **performance that lasts**, IGUs must have visible light transmittance of 1%  $T_{vis}$  or lower.

View is designed with lasting customer comfort in mind. Our IGUs have electrochromic coatings as low as 0.5%  $T_{vis}$  per customer use case.

# view<sup>®</sup>

## Smart glass built to last

View Dynamic Glass is more than a construction component – it's an experience that lasts for the life of the building

View IGUs are designed around durability. Our proprietary electrochromic technology, cutting-edge research and development, and state-of-the-art glass manufacturing facility mean our windows work as well in year 50 as they do on day one, giving occupants a smart glass experience that lasts.

### View Dynamic Glass: Built to last

- ✓ Inorganic, stable state electrochromic coating for reliable switching over time regardless of outside conditions
- ✓ Stable glare control (1%  $T_{vis}$ ), color, and appearance
- ✓ Exceeds the requirements of ASTM E 2141 with zero degradation over 100,000+ cycles
- ✓ Lasting performance to delight occupants with the benefits of electrochromic glass over the life of the building
- ✓ Proven track record installing electrochromic glass in over 50 million square feet of building space across the globe





## About View

View's vision is based around the notion that natural light is required to live a healthy and productive life, but the ordinary window is far from optimized to provide it. View's smart glass windows let in natural light and views, and enhance mental and physical well-being by significantly reducing headaches, eyestrain and drowsiness. They also reduce glare and heat, improving the energy efficiency of buildings by 20 percent.

View is headquartered in Milpitas, California, with high-volume manufacturing facilities in Olive Branch, Mississippi, and is distributed via direct sales. Today it can be seen in hundreds of installations across North America with more underway in various commercial markets such as corporate offices, airports, healthcare, government, higher education, and hospitality. Major facilities include DFW International Airport, FedEx, Facebook, Kaiser Permanente, WeWork, Overstock.com, Regeneron, and the San Francisco International Airport.

Natural light is better.  
That's our view.™