

## New Materials Result In Breakthrough Low-E Performance

### THE CHALLENGE

A product development team was formed at the Guardian Science and Technology Center to deliver a low-E coating that defied conventional wisdom regarding performance and durability. The performance objectives for this product included the following:

- Neutral transmitted and reflected color with high visible light transmission.
- U-Value (air): <0.34, SHGC >0.65, and an Energy Rating >21.
- Single-product solution and no edge deletion required for approved applications.
- Handling and fabrication characteristics similar to pyrolytic low-E.

To be a single-product solution, the key characteristic was durability. In order to accomplish this critical objective, it would be necessary for the product to approach the overall durability of pyrolytic low-E. Achieving the required level of durability in this product would likely require the use of materials and deposition techniques that had not previously been considered.

### THE SOLUTION

Extensive material analysis finally yielded the breakthrough the design team needed to make this new product a reality. The solution was Zirconia. Although Zirconia may be best known for its use as a gemstone, it is also used in many industrial applications because it is exceptionally resistant to corrosion and it is able to withstand very high temperatures without cracking or degradation.

For the first time, it appeared possible to approach the durability of a pyrolytic coating with the appearance and overall performance of a sputtered coating. According to the lead development scientist, "Zirconia proved to have a unique combination of transparency and durability that made it an ideal protective barrier."

### VALIDATION TESTING

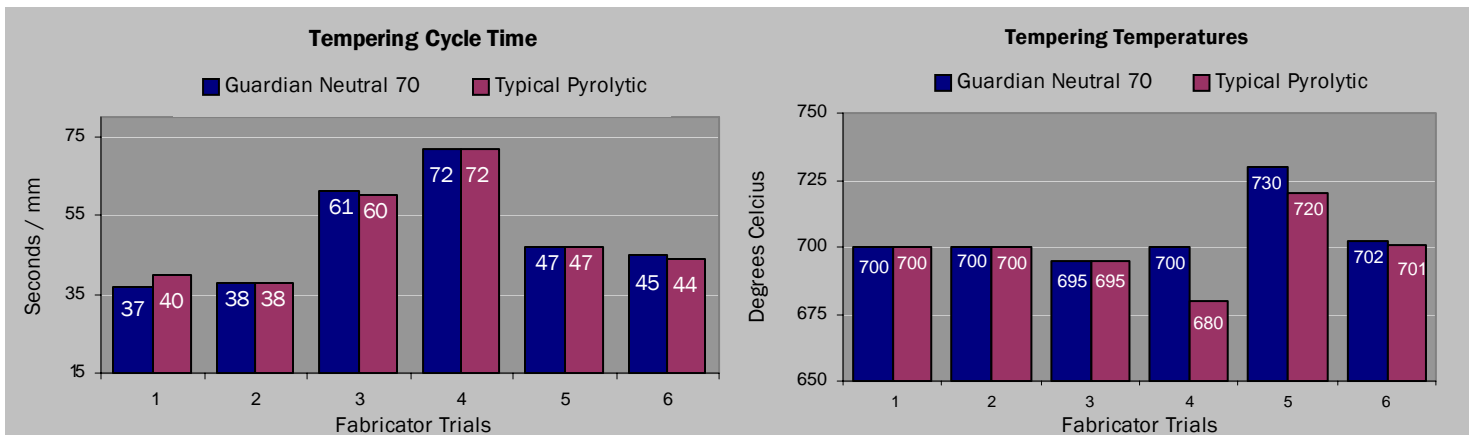
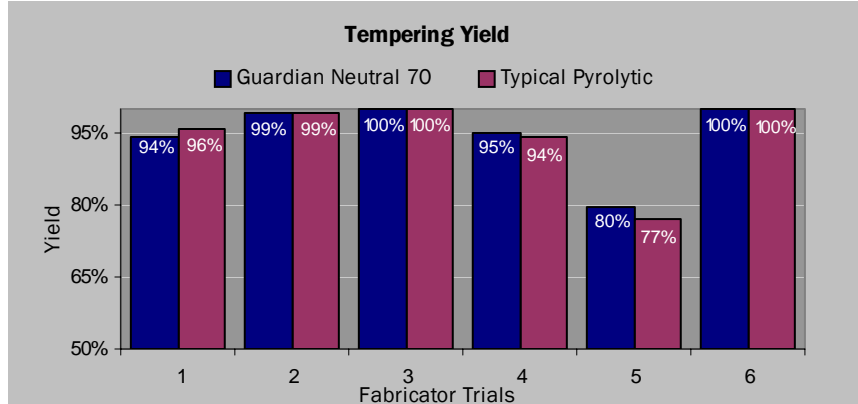
A test plan was developed to compare the performance of Guardian Neutral 70 to annealed and post-heat treated split-silver low-E and the most common pyrolytic low-E products. The test plan included laboratory environmental testing and field fabrication trials.

#### Environmental Testing

- High temperature / High humidity and Thermal Cycling Tests– Guardian Neutral 70 lasted over 7x as long as split-silver low-E and performed comparably to pyrolytic low-E in both of these tests. These environmental tests are an indication of product stability and shelf life.
- Acid Exposure (brick wash) Test - Guardian Neutral 70 lasted over 6x as long as split-silver low-E and performed comparably to pyrolytic low-E in this test. The acid exposure test is an overall indication of corrosion resistance.

#### Fabrication Testing

- Tempering trials included high volume and low volume production runs using continuous and oscillating (shake and bake) furnaces with radiant and convective heating.
- Across all tempering trials, Guardian Neutral 70 performed comparably to pyrolytic low-E with respect to tempering throughput and temperature profile.



#### Fabricator Comments Following the Fabrication Trials

- “Neutral 70 is less temperamental (during tempering) than pyrolytic low-E, especially with thinner glass. Pyrolytic low-E requires more attention and more oven adjustments.”
- “Neutral 70 looks better than pyrolytic low-E – it’s very flat after tempering with a lot less distortion and haze.”

#### CONCLUSIONS

Guardian Neutral 70 represents a new standard in durable high performance low-E. Designed for use in light commercial and residential applications, Guardian Neutral 70 provides the optical clarity and energy performance that is traditionally associated with sputtered coatings, with handling and fabrication characteristics that are comparable in most respects, to pyrolytic coatings. Guardian Neutral 70 is a single-product solution that can be used in non-edge deleted form for annealed, heat-treated, bent and laminated applications. Due to the robust nature of this coating, Fabricator process certification is not required prior to order placement.

#### More Fabricator Comments Regarding Neutral 70:

- “One always meets a new product with some skepticism, but this product was easy to handle, cut well, tempered well and insulated well.”
- “The Neutral 70 product was amazingly simple to process. The edge quality was impeccable and it tempered at the same speed as the hard coats. It just doesn’t seem possible to be a soft coat.”

For additional information regarding storage, handling, fabrication, Limited Warranty coverage or use of any Guardian glass product, please contact the Guardian Customer Engineering Group at (888) 521-9734.