Quality test for uncoated tempered glass surfaces

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Keywords

1=fabricating 2=debris 3=defect 4=tempering 5=scraper

Abstract

Because the condition of ceramic rollers is directly associated with glass surface quality, and the condition of rollers is directly affected by proper glass washing to thoroughly remove fabricating debris, an ongoing program of testing roller side surface quality would be of benefit to any horizontal tempering operation.

The author proposes a simple surface quality test for fabricators to predict the performance of uncoated tempered glass during future cleaning. This test employs a common shop microscope to observe the result of cleaning of uncoated glass with standard metal razors, such as those historically used by glazers, fabricators, and cleaners.

The wide metal window cleaning scraper, similar in hardness to glass, will not indent the surface of uncoated glass. There will always be demand for glass that can be cleaned with scrapers, because there really are no safe, practical, effective alternatives.

Introduction

When a moving scraper encounters a microscopic fabricating debris defect on a tempered glass surface during cleaning, there are a number of possible outcomes. Depending on random factors such as size and shape, the defect might be passed over without incident. Or the defect might be dislodged, but remain free (causing no scratch at all). A dislodged defect might simply be trapped in such a way that friction will cause only an invisible scratch. At worst, the defect might be trapped in a way that will indent the surface, causing a wider scratch with lateral chipping that may be visible in direct sunlight.

A quality tempered glass surface is not perfect, but an isolated microscopic fabricating debris defect is unlikely to cause a detectable scratch during cleaning. Unfortunately, poor quality surfaces are far from perfect.

Excessive levels of fabricating debris defects on the roller side of poor quality tempered glass can result in an alarming number of randomly occurring scratches during cleaning. In large numbers, these fine scratches will cause costly issues for fabricators, their customers and end users. The way to minimize scratched tempered glass issues is to minimize these defects.

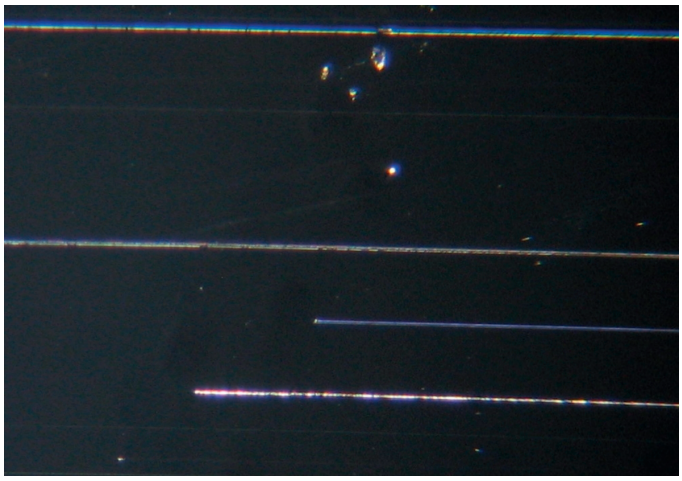

Figure 1.

The roller side of this scratched tempered glass may have had over 500,000 microscopic defects.

At least 11 microscopic defects are visible in Figure 1 - in a field of view smaller than 5mm square, For a tempered lite the size of a GPD poster (1m x 1.2m) this would project to 528,000 defects. (Or more.)

There is always room for improvement, but how can it be measured? How can managers, furnace operators and quality controllers monitor their own efforts to meet quality objectives?

Figure 2

Professional 6 inch window cleaning scraper (Triumph MK3 from JBF)

Objective

We propose a very simple and realistic method; using a wide window cleaning scraper on tempered glass to simulate the effects of future cleaning to remove stickers, paint, and other common debris. This test attempts to cause fabricating debris scratches which can be observed with a common shop microscope. A log may be kept.

The need for monitoring if tempered glass surface quality is questionable;

- Inability to resolve surface quality issues internally
- Disputes consume managers personal time and energy
- Legal fees become an issue
- Organizational impact of rework – energy, transportation, etc.
- Customers have problems meeting deadlines
- Customer concerns about brand quality

The need for monitoring when the temperer has maintained high quality standards

- Market the advantages of quality tempered glass surfaces
- Capitalize on demand for durable, easily maintained products
- Capitalize on demand for green cleaning without use of toxic chemicals
- Help customers distinguish your product from poor quality competition.

Equipment needed

- Felt tipped marker
- Straight edge
- Lighted shop microscope – 40x or 60x
- Conveniently located testing area
- User friendly worksheet or spreadsheet to log results.
- 6 inch glass cleaning scraper such as the Triumph MK3. [Figure 2]

Method

Obtain test lites at furnace unload; label each with relevant information such as date and time.

Always test the roller side.

Test promptly, while the glass is clean.

Draw two parallel lines 6 inches apart with a felt tipped marker, from one edge to the other.

Place the scraper between the lines, near one edge.

Apply firm pressure and push the scraper completely across the glass.

Observations

Draw an X at one point along one of the drawn lines near the end of the scraper's path.

Place the shop microscope over that point.

Turn on the light, and rotate the scope so that the light is perpendicular to the line.

Focus the shop microscope on the X.

Move the shop microscope slowly from one line to the other.

Keep the light perpendicular to scratches at all times.

Figures 3a & 3b show the dramatic difference proper lighting makes.

Count all scratches that can be seen, and enter the result in the log.

Report any unusual results promptly.

Comments

Test periodically - with frequencies subject to local conditions and after events that affect quality, such as equipment maintenance.

Procedures should monitor the entire usable width of rollers.

Soap and water are not used because soap residue may interfere with observations – and because the glass is already clean.

Save the location of any noteworthy defect or feature for future reference by tracing a circle around the base of the shop microscope with the felt tipped marker.

When a poor quality tempered lite is not available for training purposes, or cannot be obtained from a competitor, a rock or sandpaper can be used to create observable scratches.

When scratches are counted and logged, observations must be made at the end of the scraper's path; most scratches end there. [Figure 4]

Figure 3a

Even magnified with a shop microscope, scratches may be invisible in poor lighting

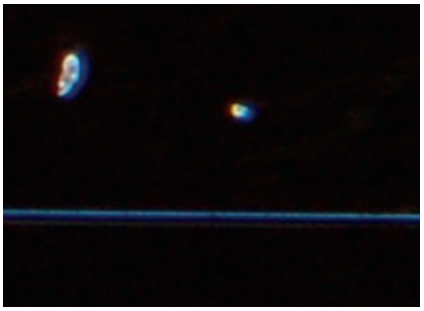

Figure 3b

When light source is perpendicular to the scratch, the scratch becomes visible.

Summary

Quality control personnel will find more defects than scratches, and more microscopic scratches than visible scratches. On quality surfaces, defects will be scarce, microscopic scratches will be rare and visible scratches rarer still.

A practical shop test for the very reasons it is not practical as a field test; glass is free and easily handled. Glass is already clean, lighting can be controlled, and batch testing is possible. A large area can be scraped and observed with a powerful shop microscope. Results are much more reliable than mere visual inspection of a "small, inconspicuous area".

Conclusions

Any statistics obtained can help increase organizational awareness and put an end to speculation about the relative quality of tempered glass surfaces.

Timely feedback will enable the fabricator to maintain - or improve, as the case may be – the quality of tempered glass surfaces without resorting to forensic methods such as optical microscopy, scanning electron microscopy, and energy dispersive spectroscopy. Cost per square foot for monitoring a batch of tempered glass will be minimal. Where feedback results in a renewed emphasis on plant cleanliness, tempering practices, and equipment maintenance, the cost of monitoring would be recoverable through sustained productivity, extended useful life of equipment, and a general reduction in costs associated with scratched tempered glass.

Author

Gary Mauer is Director of the Window Cleaning Network. A member of the Tempered Glass Quality Committee of the AUWC, member of MWCoA and a founding member of the International Window Cleaning Association. His 33 year career in the window cleaning industry was preceded by 3 years experience with a glass fabricator.

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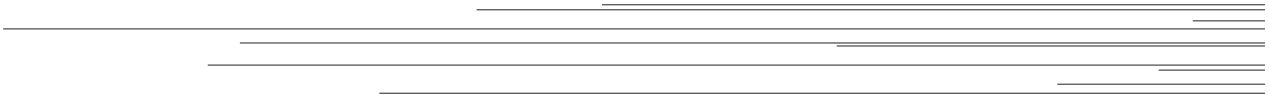

Figure 4

Fabricating debris defects cause fewer scratches near the beginning of the scraper's path. More scratches will be observed near the end.