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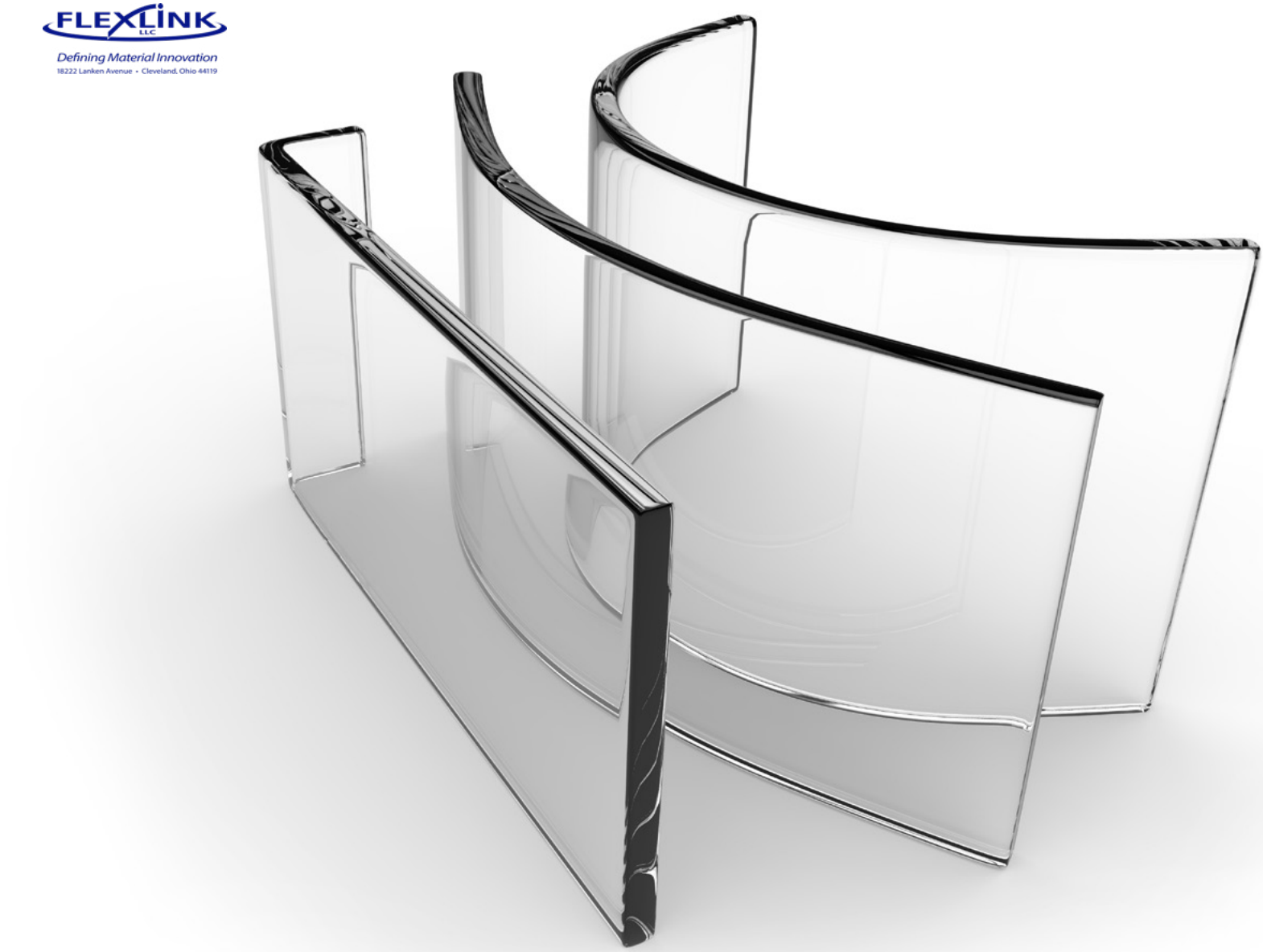


Factors to Consider When Selecting the Proper Chemistry for Glass Interleaving Paper

Glass Interleaving Paper is used when interleaving powder does not work. In most cases, this occurs because the glass surface is not perfectly flat or when specific environments cause dust and beads from interleaving powder to be problematic. Curved or bent surfaces prohibit interleaving powder from remaining in place, and the dirt and dust associated with interleaving powders can cause problems in a multitude of situations.

As a result, many glass manufacturers and fabricators turn to glass interleaving paper as an alternative. However, the range of papers available are as varied as the level of knowledge regarding their use. With this in mind, we will discuss the factors that allow a paper to effectively interleave glass.

Although this topic pertains to both glass manufacturers and glass fabricators, the remainder of this paper will use “glass manufacturers” to cover both groups.

UNCONTROLLABLE AND CONTROLLABLE FACTORS IN GLASS INTERLEAVING

Defects

Glass interleaving defects can be broken into "Uncontrollable" and "Controllable" factors. The uncontrollable factors are outside the control of the glass manufacturer and include humidity, heat and the length of time the glass is interleaved.

Fortunately, glass manufacturers can still control the quality of their glass by controlling the characteristics of their interleaving paper. The paper's thickness, pH and chemical content all work to inhibit the effects of heat, humidity and time. Additionally, it is important to exclude silicone derivatives from all pulp and paper manufacturing processes. Each factor will be looked at more closely below.

1. Moisture: A Demon for Glass Manufacturers

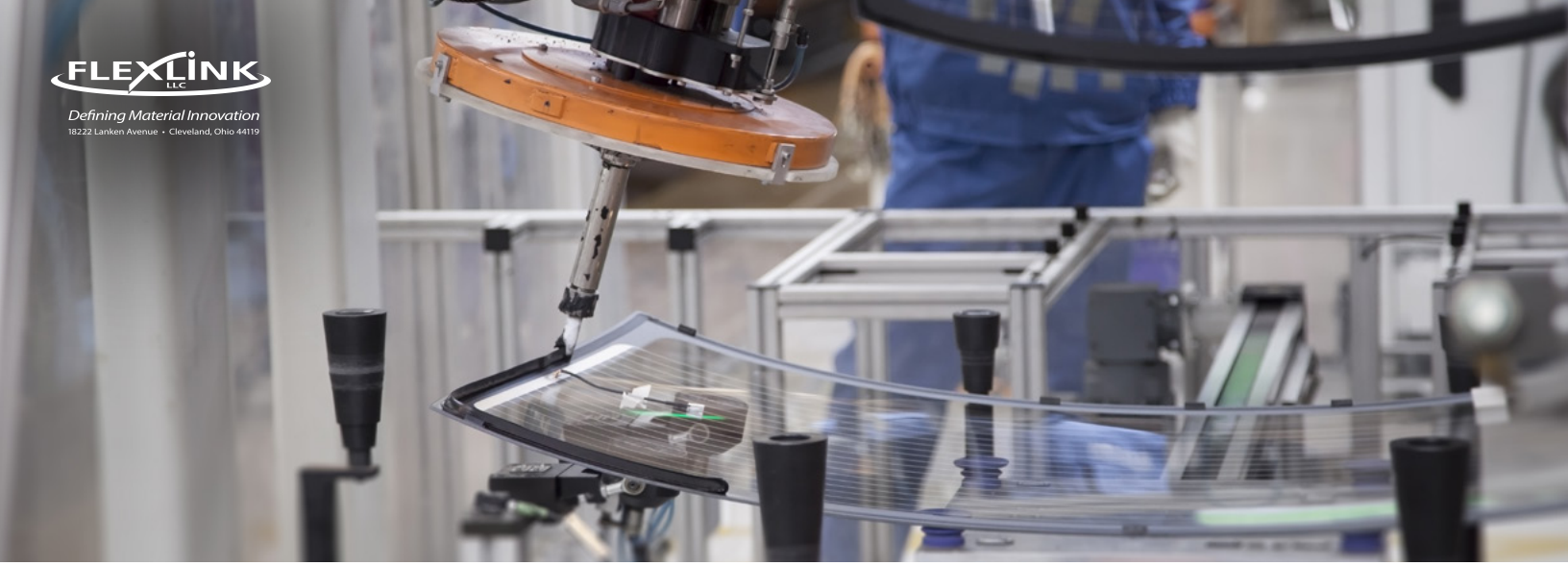
Moisture forms on glass anytime the ambient temperature falls below the dew point. Under normal circumstances, the moisture evaporates or is diluted to the point that chemical reactions cannot occur. In packaged glass however, the moisture is trapped and this ultimately leads to glass defects if the proper safeguards are not put in place.

In his article "How to Prevent Glass Corrosion", Paul Duffer of PPG Industries1 discusses the chemical reactions that occur which create staining and corrosion in soda-lime-silica glass compositions. He explains that Stage One Corrosion can take place in minutes if the glass comes in contact with water while packaged. Duffer describes the chemistry of the interaction in detail, but put simply, the water takes sodium ions from the silica glass thereby increasing the hydroxide ions and the alkalinity (pH) of the moisture on the glass's surface.

Stage One Corrosion can take place in minutes if the glass comes in contact with water while packaged.

Duffer goes on to explain "As long as the solution pH levels remain well below 9.0, Stage 1 corrosion proceeds as the predominant reaction at the glass surface. During this period, optical quality and surface integrity remain essentially unaffected……..However, unrestrained Stage 1 corrosion can lead, as previously mentioned, to highly alkaline conditions."

Finally, Duffer makes it clear that a whole new reaction takes place when the pH of the silica glass reaches 9.0 or greater. Glass industry experts call this "Stage Two Corrosion". It occurs when the hydroxide ions attack the actual silica network in the glass. The defects are displayed as "microscopic pitting of the surface" and evolve into a "widespread iridescence" or a "dense, translucent haze". Duffer also mentions reactions that occur with the moisture from carbon dioxide in the atmosphere that also creates residues.



While the overall strength of the glass is not impacted from the pitting, fogging and hazing; the optical quality of the glass is destroyed to a point that only substantial grinding and polishing can remove the defects. In many cases, scrapping the defective glass is more economical than re-conditioning it.

2. pH: The Shield that Blocks the Demon

If it remains sufficiently strong and there are no chemical reactions to consider, an extremely thin interleaving tissue will suffice to separate the glass. The problem is that as the paper gets thinner, the paper's ability to act as a pH buffer decreases and as a result, the paper's ability to prevent Stage 1 Degradation also decreases. The reverse is also true—as the thickness of the paper grows, its ability to act as a buffer improves. This happens because the pH of the entire mass of paper changes along with the pH of the surface of the glass during the Stage 1 Degradation Process and beyond.

At the same time, manufacturers prefer to use the thinnest interleaving papers possible. This improves yield and decreases shipping costs.

The solution to obtaining the most buffering capacity possible but also using the thinnest possible paper is to use a very acidic paper. In our experience, a paper with a mass of 30 lbs. per 3000 sq. ft, should have a pH of 5.5. As the thickness of the paper decreases below 30 lbs. per 3000 sq. ft, the pH should be decreased. For example, interleaving powders and liquids, which provide a much thinner layer than paper, typically have a pH of 5.0. (Helmut)

3. Resin - The Devil's Trident

Moderate to high resin levels can cause pitting and corrosion as well. High resin levels often appear as tiny specs in the sheet that can dent glass. Moreover, studies show that chemical impurities such as sulfates, agglomerate around these tiny specs. Thus, the areas around the tiny specs of resin have higher concentrations of harmful chemicals than other areas in the paper.

The removal of resin has two other benefits. First, it makes the paper stronger. Secondly and more importantly however, it makes the paper less water resistant. Absorbing water is important so the paper can act as a buffer against hydroxide ions and the alkalinity of the moisture that collects between the layers of glass.

Resin, often called “organic extractives” can be largely removed from virgin paper. Resin is the chemical leftover from the lignin (often called “pitch”) that holds the cellulose fibers together in wood. Hardwood contains higher resin levels than softwood.

Properly aging the wood and thoroughly washing the pulp both reduce resin levels. Pulp mills that want to reduce resin levels age their wood for a year or more and send the pulp through significantly more washing.

Unfortunately, higher softwood percentages, extended aging of the logs and increased pulp washing are all expensive. As pulp mills are unable to process and segregate different types of pulp, very few pulp mills are willing and able to make pulp that is suitable for making glass interleaving paper.

Other Factors Promoting Glass Corrosion

If moisture is the demon that causes defects, then ambient heat is the fuel that feeds the demon. Using our accelerated aging room here at Flexlink, we have proven time and again that the chemical reactions discussed above happen more quickly as the ambient temperatures increase. All else equal, the rate of degradation happens faster under hotter conditions.

Interleaving glass while it is still warm can cause major problems if the wrong interleaving paper is used.

The heat and humidity can vary by time of the year or even from week to week or day to day. It is prudent to investigate if your defects coincided with unusually humid days at your facility or high humidity at your customers’ facilities.

In some cases, the effects of ambient heat are minor when compared to the effects of furnaces and tempering lines. Interleaving glass while it is still warm can cause major problems if the wrong interleaving paper is used. While some clients have added equipment to extend cooling sections and/or added extra climate control equipment, which also comes with higher utility bills; this is not required if you use the proper paper.

WATCH OUT FOR ADDED CHEMICALS IN YOUR PAPER

Glass Manufacturers should also be aware that if their paper is not produced specifically for glass interleaving, the paper mill can add chemicals to the paper at any point. Typical paper mills will often incorporate chemicals to decrease cost and increase efficiency assuming that the paper they are producing will go into flexible packaging and other specialty applications. Silicone based defoamers are one example of this.

In paper manufacturing, silicone-based defoamer agents can decrease cost and are therefore gaining in popularity. Unless the paper mill producing your paper is custom manufacturing a glass interleaving paper specifically for this application, they are likely to maximize efficiency without regard for how chemical changes can impact glass products.

In fact, one of our current customers first came to us with a defect that was happening for months. Our laboratory analyzed the defect and determined that there was a thin coating of silicone on every window. As it turned out, the paper mill had switched to a silicone defoamer with the goal of decreasing their cost. The glass defect was costing hundreds of thousands of dollars annually. This customer switched to Flexsheen® and has not had an interleaving-related defect since.

VIRGIN PAPER

It may seem obvious, but no chemical controls are possible with recycled paper. Regardless of the level of cleaning, recycling facilities are not able to remove 100% of the dirt and debris. Moreover, recycled pulp mills are not able to wash out all of the impurities. Therefore, glass interleaving paper must be 100% virgin.

While this may seem cut and dry, specifying 100% virgin paper can be confusing. This is because in some segments of the paper market, industry standards allow manufacturers to use up to 20% recycled pulp and still label their paper as “virgin”. Therefore, glass manufacturers should specify that their paper be made with “100% virgin cellulose fibers”.

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SUMMARY

Selecting a proper glass interleaving paper is much more difficult than it would initially appear. Ambient heat; the heat from furnaces on production lines; ambient moisture; as well as the length of time the glass is interleaved all dictate the need for glass interleaving paper with very specific chemical controls. Here is a checklist to use when choosing the right glass interleaving paper:

- Is the paper made with 100% virgin cellulose fibers?
- Is the pH of the paper 5.5 or below?
- Are the resin extractives controlled?
- Are either the sulfates or reducible sulfur limited to the proper level?

PARTNER WITH FLEXLINK FOR HIGH-QUALITY GLASS INTERLEAVING PAPER

Our Flexsheen® line of products is not the least expensive paper on the market. However, every detail behind producing a quality glass interleaving paper has been considered in designing this family of papers. Considering the cost of random QC problems, Flexsheen® has the least total cost of ownership of any glass interleaving paper that can be purchased.

Please **contact us** to discuss how Flexsheen® Glass interleaving paper may help resolve your QC problem.

Sources

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