

The New Generation of Flat Glass Inspection

The quality requirements for flat glass have continuously increased over the past years. This relates to display glass in the same way as for glass types, like architectural glass, automotive glass, thin glass and coated, respectively laminated glass. More than ever, automated inspection systems are expected to provide the tools to fulfil these requirements, to ensure high product quality, as well as high yield.

In 1995, Dr. Schenk first delivered inspection systems to the display glass industry. Since then, the product range has been continuously expanded to serve all aspects of quality control for any kind of flat glass. Thereby, the demanding requirements of the display glass industry have led to inspection solutions, manufacturers of all flat glass application areas can benefit from.

Online Inspection in the Float Line

Today, nearly every float line worldwide applies an integrated online inspection system. The two basic needs of proper float glass inspection, however, can hardly be fulfilled by conventional inspection systems that are available on the market.

Dr. Schenk addressed this need and developed a unique optical concept that accomplishes true differentiation between critical and non-critical defects, as well as precise defect size determination for correct classification.

The automated inspection system *GlassInspect* is based on a unique dual illumination concept. This proprietary two-channel design accomplishes best image quality with the highest possible contrast of the defects to be detected. Significant and clear images of the different glass defects enable production staff to trace back to the defect cause without delay. Potential production problems can be addressed quickly, allowing the achievement of a continuous high yield.

Correct classification of the detected defects is imperative to determine the true quality of the glass. But, the classification can only be as good as the quality and significance of the initial defect image detected by the inspection system. Low contrast images with little information content lead to incorrect and vague defect size determinations.

The Dr. Schenk system solutions apply a different method for gathering defect information, so that more relevant details of each defect are recorded. The special optical design of *GlassInspect* delivers microscopic-like images of the glass defects that enable the precise measurement of the core size, as well as the distortion size of the defects. Critical defects can be reliably differentiated from non-critical impurities.



Figure 1:
The Dr. Schenk glass vision system *GlassInspect* establishes a new generation of defect inspection

This clear differentiation also builds the basis for an established rejection criteria. The limits, that specify the minimum size of defects to be rejected, can be defined much more precisely, because the measured defect sizes reflect the real defect sizes on the glass. Of course, the total amount of unnecessary rejects, which are attributed to misinterpretations of the real defect dimensions, are drastically reduced. This is particularly true for defects with a dimension close to the limit value.

Figure 2 shows an example of real glass defects, detected by the inspection system *GlassInspect*. The two clear images of each defect demonstrate how big the difference for the measurement of the defect size can be, dependent on whether the core size or the distortion size needs to be assessed for the respective defect type. Only the examination of both values allows the correct evaluation and classification of a glass defect.

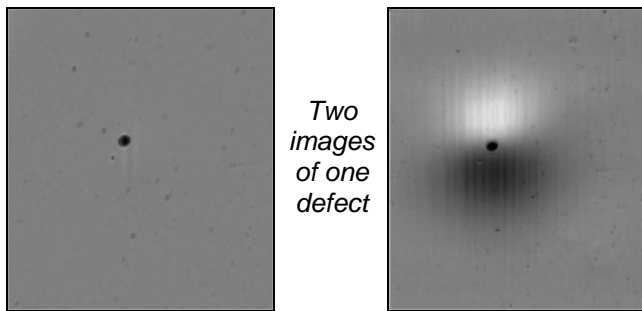


Figure 2:
Clear and meaningful defect images of one defect lead to enhanced defect classification

Inspection of Coated and Laminated Glass Sheets

The quality control of coated and laminated glass sheets becomes more and more important. Up to now, manual inspection has been widely applied, but the continuously increasing customer requirements has led glass manufacturers to start investigation of automated optical inspection.

The characteristics of coating defects require a different inspection system concept. While float glass inspection takes place in transmission mode, the optical components for the control of coatings are arranged in reflection mode to achieve highest sensitivity for coating defects.

Again, production staff benefit from the high quality of the defect images for this inspection task. The advantages of the system, already well proven in the float line, are also similarly applicable for the coating process.

Display Glass Demands Highest Inspection Needs

Glass that is used for flat screens demands, up until now, the highest requirements from inspection systems. Defects down to a diameter of 10 microns need to be reliably detected during glass manufacturing and processing. Even the slightest deflecting defects are of relevance, which can be made visible to the human eye during manual inspection only with great effort. This challenge has been solved with an illumination setup that has been specifically developed for the inspection of glass. Today, the BEAMED_LINE illumination is integrated into all Dr. Schenk glass inspection systems and successfully operates at many glass production sites worldwide.

Edge Inspection Indicates Risk of Glass Breakage

In addition to the indispensable defect inspection of display glass, the control of the glass edges can not be missed out. The smallest cracks and chips, that can occur during the process of edge grinding and corner cutting, can cause the glass sheet to break during a successive process step. This leads to a long-winded production stop until the pieces of broken glass have been completely removed from the line again. To prevent such production downtime, it is essential to inspect the edges and corners for defects with highest sensitivity. Even more, the shape of the edge must be conform to the given profile.

The size of the glass sheets, which are processed in this industry today, offer a length of more than 2 m. Visual inspection is simply no longer feasible.

The unique edge inspection system from Dr. Schenk responds to this need. An innovative optical concept enables the relevant edge area to be recorded from three directions. The resulting high-resolution images, taken from the edge view, as well as from both sides of the edge, lead to a clear statement of the defects. This unique system provides a sensitivity and accuracy, which is unmatched in this industry.

The modern inspection system solutions from Dr. Schenk are already widely adopted in the display glass industry. System solutions for all other industries benefit from this technological lead as completed projects, e.g. for architectural glass, prove. Dr. Schenk offers a complete range of high-performance inspection systems for any kind of flat glass inspection, from float glass to the final glass sheet, including edge inspection and dimension measurement.