

Quality controls and measurement technologies on moulded flat glass

P. Eikmeyer, LASOR AG

1 Introduction

Online-measurement of defects and optics

In the course of internationally increased quality demands on processors of glass industry, especially car producers, an automated online-inspection of the ribbon regarding glass stresses is carried out for some time, which means optics and defects in glass in production line.

A contactless, reproducible 100%-inspection of the material with registration of all relevant glass defect is also necessary in the course of ISO 9000 ff. An online-measurement of defects and optics has different advantages in contrast to an offline-method. Some of them may be exemplary quoted here:

- 100%-control of test material,
- minimal personnel expenditure by an automated measuring process and
- reduction of investment as well as running costs

Advantages for glass processors as well, which follow from this:

- constant quality level,
- reproducible measurements and
- capture of statistical figures and saving of customer-relevant data

These are only some arguments, which have led to an automated online-inspection of the measurement of faults and optics. In the past, inspection of defects and optics was carried out with separate measuring plants.

Because of 40 years experience in inspection of surfaces in different fields, it has been possible, to develop a measuring plant, which is able to capture, classify and standardize point defects and optical defects online during flat glass production. Lighting unit and related camera are built up modularly, so that every kind of testing breadth can be carried out economically with minimal construction expenditure.

2 Physical principles

Online-measurement of defects and optics

Deflection and absorption of light through a transparent material, like e.g. flat glass, can be measured at the same time by above-mentioned measuring process. The system mainly consists on a lighting unit below glass pane and reproducing system above the glass.

The source of light, which is based on a lighting diode (LED), can be electrically switched between a 2- and 4-phase-configuration, so that one phase is active at any time. The high switching frequency guarantees a complete sampling of the material by a conveyor speed of up to 30 m/min.

Material is inspected by a CCD-camera (charged coupled device), which directly looks on lighting unit through glass. the size of a pixel, which is seen on glass surface, amounts 0.1 x 0.1 mm.

LED have a lifetime of more than 10 years. Using this light source, the glass processors do have a dramatic reduce of maintenance costs.

Due to the measurement principle , the system is not affected by foreign light influences. The compact design only requires 1 m for the installation into the flat glass production in glass flow direction.

The camera signal with information about defects is analyzed in post-switched hardware. The defect information are displayed on a user-friendly surface. Additional functions as e.g. Defect Map, Grey Scale Image (continuous defect display, digital defect picture) and statistical evaluation offer a numeric as well as graphic representation. The defect classification via neuronal network is naturally content of the system as well as an additional illumination for scratch detection (optional). Only a single PC is necessary for detection and representation of defects.

Illumination: Photo of defect inspection system, electronics included (source LASOR AG)