Melting and refining lenses produces bubbles, particle inclusions and surface defects in the material. They do not only detriment the imaging quality of optical components, but also hamper further processing of the lenses. DIN ISO 10110-3 is therefore used both as a specification for optical systems and for characterizing the quality of transparent semi-finished products.

Bubbles and inclusions of particles lead to scattering and/or the absorption of light in the material. The consequence of these effects on imaging quality is nearly proportional to the projected cross-sectional area. Therefore, the quality of lenses concerning bubbles is traditionally characterized by specifying the visible cross-sectional area of the errors per unit of volume.

DIN ISO 10110-3 generally adopted this characterization. Additionally, the weighing of a larger number of smaller bubbles or inclusions and the size limit of (impermissible) defect clusters is defined.

**Inspection system**

The inspection system is based on the patented Sensor Purity of the Fraunhofer IOSB. It detects and differentiates – nearly independently from the object geometry – changes in transparency, inclusions of particles or bubbles as well as disturbances on the surface (e.g. dust). Unlike conventional systems, Purity offers complete inspection in one view by means of multi-channel image acquisition.

By detecting surface dust, the system is able to achieve exact and robust error detection and classification in normal production environments.
A three-channel image of the objects is initially acquired. Each channel delivers an image of the specimen obtained with a different image recording configuration. As a result, the various defects are manifested differently in the individual channels. The sizes of the individual anomalies are initially determined by downstream filtering and segmenting. Robust detection of the type of anomaly (particle inclusion, bubble or dust) is achieved by comparing the signals in the different channels.

The detection of dust particles is suppressed.

Separate characterization according to DIN ISO 10110-3 is performed for bubbles and particles. The parameters determined are product-dependently compared with definable tolerances. The comparison result in a test decision (acceptable/rejected) which is automatically displayed to the user and enables automatic rejection (see picture of the system’s user interface).

In addition, a table presents the hype and size of each detected defect.

For future demonstration, the image of the specimen is show with the relevant defects indicated by a colored frame.

If necessary, a protocol can be created and archived for each specimen.

Technical characteristics

- Inspection of transparent, but also complexly shaped objects
- Differentiation of embedded particles and bubbles
- Detection of surface defects (dust)
- Object sizes from mm² to dm² can be inspected using different lenses
- Image recording and analysis in real time
- Test decisions within mere milliseconds
- Detection of dust particles prevents false alarms in a regular production environment