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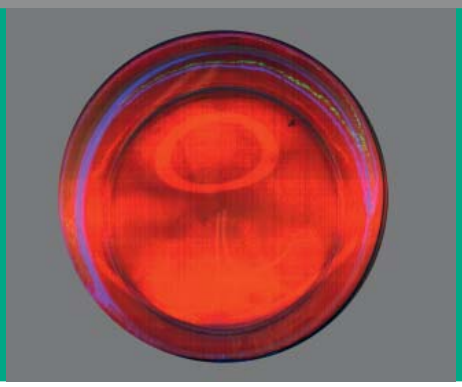
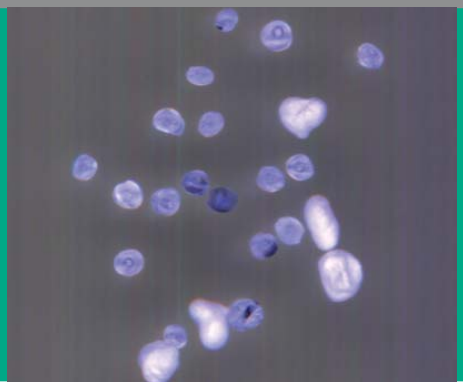

Purity
Automatic Inspection of transparent Materials

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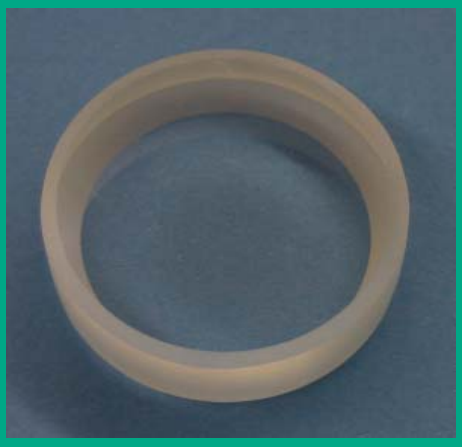
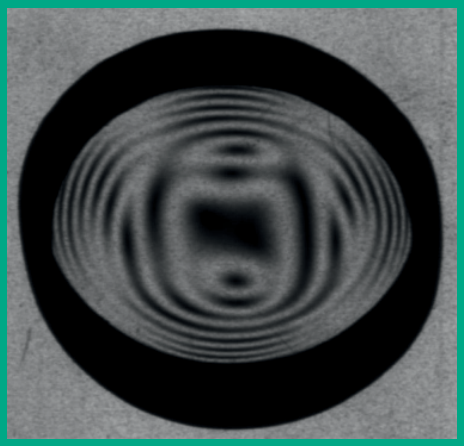
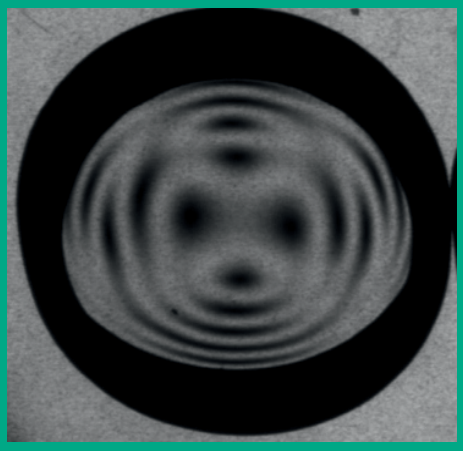
Currently industrial image processing faces the challenge to detect inclusions and air bubbles within transparent materials of any shape. The shapes range from flat glass to curved glass and from lenses and spherical objects to granulates and similar objects.
The patented Purity system, developed by Fraunhofer IOSB (Institute of Optronics, System Technologies and Image Exploitation), detects and distinguishes changes in transparency, inclusions of foreign objects and air bubbles – nearly independent of object shape. In contrast to conventional systems, Purity allows in most cases complete inspection from a single perspective.
The core of this flexible, reliable inspection system is either a line scan camera or a laser scanner, depending on the particular task.
Images are acquired and analysed in real time, allowing inspection and sorting of materials at flow velocities of up to 3 m/s.

Application Examples

- Inspection of clear plastic granulates
  Granulates of clear plastic are an intermediate product used in manufacturing plastic items. Irregularities in shape or bubbles are usually of no importance if the granulate is melted down again later in the production process. Soiling or turbidity, on the other hand, can result in faults in the finished product and must therefore be identified and distinguished from irregularities in shape and bubbles. The Figure above shows an example image taken of such granulates using Purity. Foaming (white) and turbidity as well as embedded foreign objects (black) can be reliably detected. Faulty items can be sorted out in free fall or during ejection from a conveyor belt.







- Inspection of curved glass
  As is the case with other glass objects, soiling, scratches, cracks and local tension can reduce the quality of curved glass. Faults can also be caused by embedded defects in laminated glass. A laser scanner-based solution is able to detect such defects in three-dimensionally expanded glasses. Faults can be classified using a multi-channel system. Two-channel sensor modules, providing an inspection width of 380 mm are available. They can be combined, thus enabling the inspection of large curved glasses with a depth extension of up to 300 mm. It is possible to automatically detect point defects, hair, fuzz, foil defects and scratches within the glass object passing the measuring field only once.
- Inspection of glass tubes and cylinders
  A dual axis sensor arrangement allows for the entire inspection of glass tubes and cylinders on-line.
- In line measurements of drawing forces
  An additional polarization option allows precision measurements of polarization effects in the material. One application of this option is the measurement and control of drawing forces in production pro-cesses. The drawing forces are measured by an evaluation of induced birefringence.

Device Options

Inspection of flat objects, such as granulates, fragments or flat glass, is performed using single or multi-channel systems based on line scan cameras.

Three-dimensionally expanded objects, such as hollow glass or curved glass, are inspected using a single or multi-channel laser scanner.

In both applications, one channel is used to determine the transparency profile of the object. This is compared with a specified (good) profile. Faults detected in the transparency profile can be the result of deviations in shape, deviations in transmission, embedded foreign objects or surface faults. The type of fault can be determined and classified using additional inspection channels. Alternatively, the colour gradient within the inspected item can be checked when inspecting flat objects.

Optionally object dependent changes in the state of polarization of the light by the objects are detected and precisely measured. Polarization of illumination and detection are adaptable on the specific task. This option allows the visualization and measurement of induced birefringence or the rotation of polarization in optical active materials (e. g. solutions with different concentration of sugar).

Technical Properties

- Inspection of transparent objects having even complex shapes
- Detection of variations in transparency
- Minimal influence of object shape on inspection result
- Systems based on line scan cameras for inspecting flat objects
- Systems based on laser scanners for inspecting three-dimensionally expanded objects (e. g. curved laminated glass)
- Detection and classification of particle inclusions and bubbles according to DIN ISO 10110-3
- Optional high resolution measurements of induced birefringence (better 0,1 nm). For given object geometries allowing:
  - object classification according to DIN-ISO 10110-2
  - in line measurement of drawing forces
- Material flow velocities of up to 3 m/s
- Real-time image acquisition and analysis: sortingdecisions within milliseconds