PRODUCT REPORT 2008

OPTICAL PROCESS MONITORING- AND REGULATION IN THE FABRICATION OF AMPOULES

The permanent control of the using properties of the manufactured products constitutes a principal task of quality control in ampoule production. Relevant criteria are for example contour characteristics as ampoule length, diverse diameters and other geometrical features.

The measurement of the ampoule geometry is carried out optically, and traditionally at the finished product. Defective ampoules are detected and eliminated – quality is generated via sorting.

The larger benefit for both, the customer and the manufacturer, is to produce quality from the outset. Sorting would then not be necessary. Production of quality means process monitoring and regulation in real time if required.

To solve this demanding task OTTO Vision Technology GmbH developed an optical measurement system which is attached directly in the producing tool (fig. 1).

The measurement system contains:

- an image processing system CVS (CVS = **C**omputer **V**ision **S**ystems),
- two high resolution matrix cameras CCD,
- two telecentric lenses to gain optically faultless images,
- several illuminations as well as
- measurement software.

The cameras are applied in two teststations:

- Station 1 visualizes and inspects the glass cylinder in the process of production.
- Station 2 inspects the finished ampoule before they leave the tool.

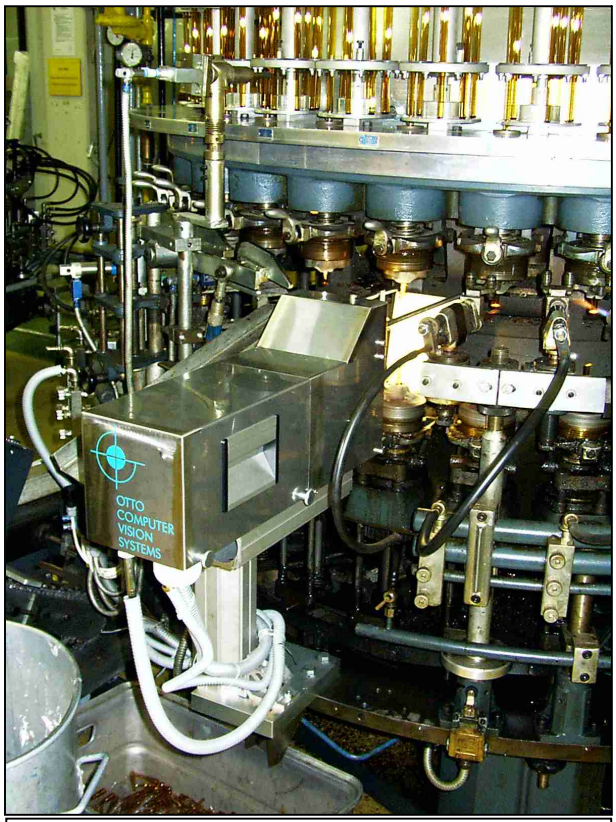


Fig. 1 Measurement station at the machine

Teststation 1:

Fig. 2 and 3 Diameter inspection at the hot glowing glass tube (2 different articles)

The glass tube in production is heated up by multiple burners. During the following process the material is stretched to the geometrical nominal measure. The first teststation serves the measurement of the hot glowing tube area (fig. 2 and 3). The diameter value is taken and calculated in real time which means during the movement. It is for regulating the duration of combustion and thus to directly influence the later ampoule geometry.

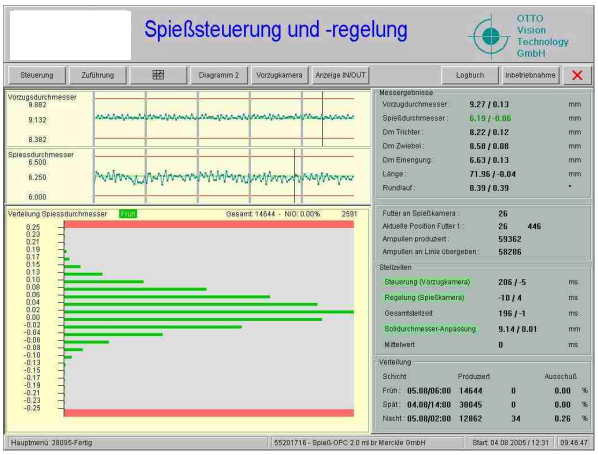
Teststation 2:

Fig. 4 and 5 Geometry inspection at the finished ampoule (2 different articles)

The camera of teststation 2 inspects the visible outer contour of the finished ampoule. The analysis of the values serves also to regulate the production process.

Image recording and evaluation are independent from glass colors (white and brown glass etc.) at both test stations. The accuracy of the measurements is better than 50 µm.

Statistics:



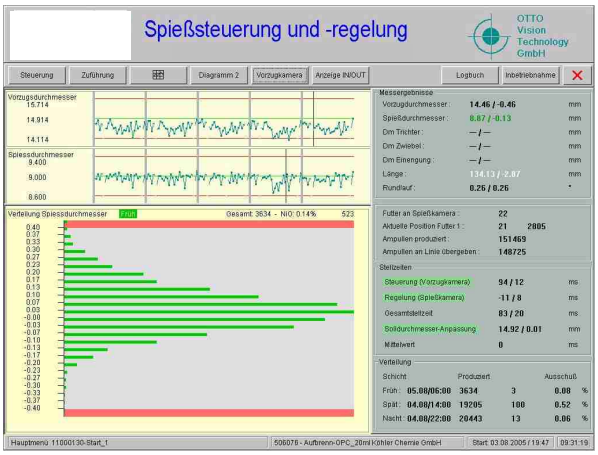


Fig. 6 and 7 Statistical process analysis (2 different articles)

Directly after the inspection the measurement results are displayed on the monitor, stored in data files and printed (as an option). The measurement station can be integrated in a network. Thus the data can be upgraded into the network.
The measurement software includes tools for statistical evaluation of the accrued measurement values and other machine information (burner position, duration of combustion and so on...). This data analysis provides the basis for long time stable process control.

Since more than 10 years the OTTO Vision Technology GmbH has been developed and manufactured modern optical test systems for the Glass industry which are based on the application of digital image processing. The following devices belong to the top product:

- Hot-end testsystem to optical non-contact inspection control of hot glowing glass containers after the forming process
- Measurement automates for optical sampling of glass containers
- Measurement automates for optical sampling of glass containers in the production (cold end)
- Measurement station and measurement tables for optical measurement of glass containers and products

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