Pellet with contamination (figures: OCS)

Pellet Production. With the aid of powerful line scan cameras, it is possible to combine qualitative online product monitoring and simultaneous quantitative sorting on a production scale. As an additional benefit, the mixing ratio of masterbatch and compounding materials can be established exactly.

Pellet Scanning in "Free Fall"

LAURA TARRACH

Fig. 1. Model PS400C quality control system for plastic pellets

Until now, quality control (QC) and quality assurance (QA) of pelletized material has been based on two different methods with the same objective, namely, improving product quality in the form of qualitative pellet inspection and quantitative sorting.

Inspection is achieved by means of systems that are used only in a laboratory as well as by means of systems that detect impurities in and on the base material in the form of online monitoring during the production process **(Title photo)**. The direct objective is analysis of the impurities found with the intent of evaluating the sources that contribute to off-spec material. The primary objectives are correction of the causes and prevention of non-conforming production. In this way, for instance, the contaminants detected and analyzed can be traced back to burnt residual material in the conveying tubing, cleaning of which can raise and stabilize pellet quality.

Sorting into contaminated and uncontaminated material during production also serves to increase product quality, albeit by means of "simple" diversion of contaminated pellets and foreign particles. This procedure is not targeted at exact analysis of possible "black spots" and their causes, but rather at quantitative cleaning of the base material.

Looking back at the past of polymer raw material monitoring, it can be seen that this sector has been characterized by a high degree of innovation and continuous development. Inspection of individual pellets on a light table was relegated to the past a long time ago, and automation has almost completely eliminated manual sources of measurement errors, resulting ultimately in considerably higher expectations regarding product quality. These are being addressed by specific approaches to implementing and maximizing precise, high-resolution detection of non-conforming material. Both of the techniques presented have reached a level of maturity that satisfies the varying expectations regarding QC and QA among producers, but still have drawbacks.

Automated offline laboratory monitoring offers only limited promise of success in terms of maintaining stable product quality during the production process, a fact that has been common knowledge for some time. Obtaining measurement results and the feedback that is so urgently needed entails enormous time delays – real-time and effective intervention into the (off-spec) production process does not occur. Moreover, the small sample size permits only random inspection of the base material and is representative of the actual amount produced only at the per-thousand level.

Online monitoring systems address these drawbacks by providing a direct connection with the production process, processing a much greater throughput and presenting measurement results that are much closer to real time. Not only the shortened response time is critical for im-

Translated from Kunststoffe 12/2010, pp. 119–120
Article as PDF-File at www.kunststoffe-international.com; Document Number: PE110626

proving product quality; the volume of pellets actually inspected, and thus the representativity of the random sample, which rises to the percent range as a result of the online connection, also plays a major role.

This leads to a simple yet effectiveness- and efficiency-increasing conclusion: if online inspection systems achieve quality control in the percent range for production with a volume in the two- to three-digit ton range, production at a lower volume experiences almost 100 % material monitoring.

It is precisely here that the sorting function gains in importance: with almost 100 % online inspection of pellet quality, diversion of off-spec material during the production process can almost guarantee optimal product quality.

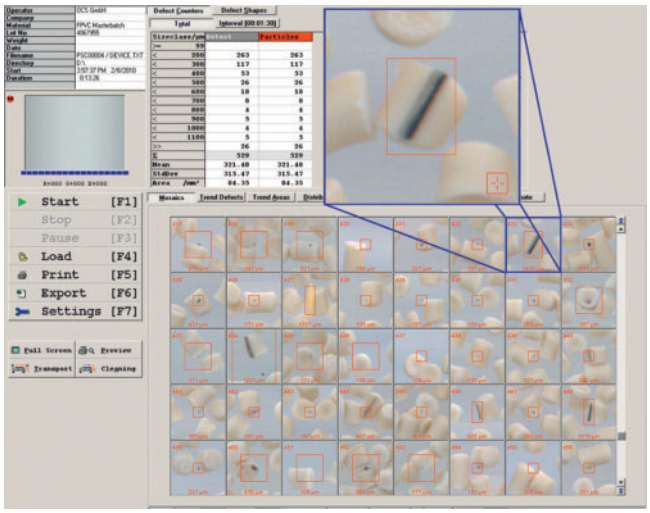

Fig. 2. Analysis and representation of detected impurities in mosaic view

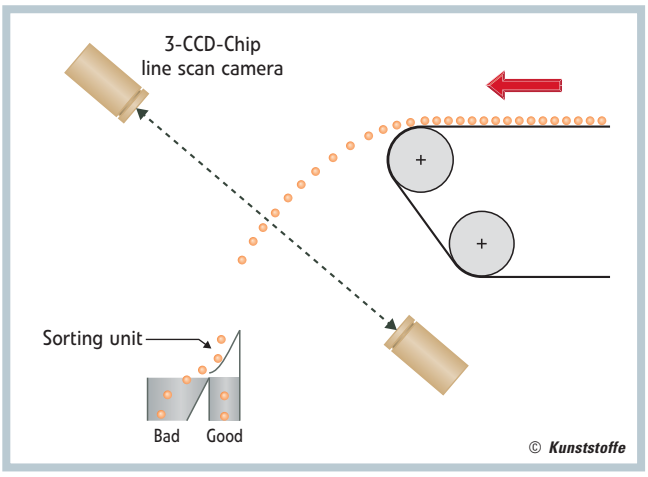

Fig. 3. Two opposing cameras inspect the front and back of the pellet in free fall

Optical Scanning System in Production

With its PS400C **(Fig. 1)**, Optical Control Systems GmbH, Witten, Germany, has now successfully linked qualitative online production monitoring and simultaneous quantitative sorting on a production scale.

The unit's package of two 3-CCD-chip line scan cameras for detection of non-conforming material (contaminated pellets, foreign particles in the base material) achieves a resolution of 100 µm at a throughput rate of up to 800 kg/h, ensuring not only extremely precise measurement at a high performance level, but also storage of particle images as well as a long-term accessibility and retrievability for statistical processing of the data collected that has no equal on the market **(Fig. 2)**. Optimal production monitoring and control as thus assured.

Furthermore, to provide a satisfactory response to customer requirements, the PS400C is manufactured in an additional version (equipped with two 1-CCD-chip line scan cameras) that does without detection of non-conforming color yet still measures particulate impurities 50 µm and larger in size at a throughput of up to 800 kg/h.

The clever preparation of the material to be inspected into one layer of singulated and uncharged pellets, and the measuring range placed within the focus of two opposing cameras **(Fig. 3)** permit the inspection of each pellet from both sides "in free fall". The option of being able to determine the mixing ratio of masterbatch and compounded material exactly at such a high throughput represents an additional benefit.

What is likely to be especially interesting for material suppliers is the system's ability to provide quality control of highly transparent pellets, which until now has proven to be extremely problematic because of the reflection characteristics of such pellets. For this case, a special illumination arrangement generates a measurement environment that is tailored to the specific characteristics of highly transparent pellets. Commonly occurring measurement errors are thus eliminated, with the beneficial consequence that even this high-priced material can be subjected to a suitable quality inspection, thereby preventing off-spec production. ■

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