Optical Control Systems for the highest Standards

Best Quality Control for the Petrochemical Industry
OCS Optical Control Systems

As one of the world’s leading manufacturers of optical testing systems for quality control, OCS supplies customised and complete solutions in the fields of digital image processing, optical measurement and automation.

Our systems ensure maximum product quality control. With the aid of precision cameras in conjunction with high performance online image processing, even the smallest defects in polymer products are detected, located and analysed in detail.

The applications for OCS systems range from laboratory use to complete integration into the production process.

Leading manufacturers in the petrochemicals and polymer industries benefit from these features. Everywhere in the world, our system solutions are successfully in service. Already, most of the raw material producers are OCS’ customers, and are highly satisfied. A reference list is available on demand.

With a highly expert and innovative team of development and production engineers, OCS supplies top level technology and know-how worldwide - always at the leading edge with our systematic research and development work. Our manufacturing processes, delivery, installation and user training are also state of the art. Service to our clients is our paramount aim: in no time we will repair damaged systems worldwide - guaranteed.

A Mission Statement

Our continued goal is to provide the polymer industry with quality control systems that are optimised with regard to production and purpose, and to offer complete solutions with solid and up-to-date technology at reasonable prices. To achieve this we constantly improve our production expertise and technical knowledge, and widen our all-round understanding of functional requirements.

OCS is committed to provide quality products and services to its customers within the agreed delivery time. OCS will strive to continuously improve quality, delivery and responsiveness to assure customer satisfaction. OCS strives to widen its world-wide market share to be the world-leader in providing the highest value products and services to our customers.

Innovation Award

In 2005 OCS won the German Innovation Prize for their successful introduction of outstanding innovation and their business conception. They have determined to establish new technologies, devise innovative ideas and extend the high-tech equipment. OCS has a unique selling point in the world market. Through the progress of different processes of quality control for the production of polymers both in the petrochemical industry and with processors, OCS became successful and an evergrowing market leader. Its measuring method became the standard for the quality control in the plastics industry.

November 2005
Your partner to be with
Applications

Plastics have become indispensable nowadays, and the areas of application are constantly broadened. The level of the requirements has risen in equal measure.

The industry demands for high quality raw material, that needs appropriate "online controls" to guarantee best properties for the fields of polymerisation, processing and application. Therefore it is essential that the extrusion process is checked for function and documented, as the polymer film should be clear of contamination and gels. It is important to detect inhomogeneities as soon as possible so the cause can be eliminated at an early stage of the process.

The rheological behaviour of the polymer melt is defined by the molecular structure and allows conclusions to the extrusion process.

The quality of the granules, e. g. the size and shape, has an influence on the pneumatic conveyance and of course also on the material flow in the feeding process and extruder during high performance extrusion.

For further processing the frequency and size of gels and black specks in the film must be determined. These affect the optical appearance of the film and reduce the mechanical stability and ability for treatment, e. g. printing, laminating etc.

The surface quality is also an important QC criterion when producing glossy and transparent films. Most thermoplastic material contains additives for processing and preservation, the content of which has to be analysed during quality inspection.

OCS has developed a modular conception of testing systems and optional devices which can be combined according to requirements:

- Pellet/Powder purity
- Size & Shape distribution
- Gels & Contamination
- Additives Measurement
- Rheology
- Haze, Gloss, Thickness Measurement
- Pellet Transport System

The various systems are described on the following pages, showing all options for a fully automated testing line. With these instruments all quality control requirements in modern plastic production and plastic conversion are fulfilled, offering tools for flawless history tracking of all critical parameters, for effective process control and for root cause analysis, creating a solid basis for process improvement.
Powder and Liquids
Powder Testing System PT2C

The Powder Testing System PT2C, equipped with a 3-CCD-chip colour camera, counts and classifies contaminations. Colour classes can be defined with the "teaching" tool to detect discolorations and foreign bodies which are different in colour from the bulk material, such as PVC, PP, PE etc.

The system is capable of detecting contamination and discoloured powder particles (pink, yellow, brown, black, etc.). These irregularities are sorted into different class sizes which are completely user definable.

Furthermore, it is possible to define alarm limits. If these are exceeded, a potential-free contact is activated.

The PT2C can be used for laboratory purposes as well as for online inspection. The powder can be submitted as a sample or it can be withdrawn from the production line by creating a bypass. Using a bypass system gives the user the advantage of direct inspection of the material during the production process. This allows faster response in order to prevent off-spec production.
Pellet Inspection Systems
Pellet Scanning System PS25C

The PS25C Scanning System is used to analyse transparent, opaque and colour pellets. The pellets are inspected with a high-resolution colour camera for contamination, discoloration and foreign particles. The testing material is fed into the appliance through the hopper. The pellets are conveyed separately to the inspection zone via a vibrating channel. After the optical evaluation, the contaminated pellets can be separated into a different container (sorting unit option). Measuring errors are eliminated by use of numerous additional optical components. After defining colour/size classes and alarm limits the recorded data are stored in a test report to enable future analysis. Also the recorded images and measured data can be observed on a screen during the measuring process. Installation in the bypass guarantees production, monitoring and rapid reaction to any occurrences. The material throughput is approx. 40 kg/h.

High Speed Pellet Scan System PS200C

Another new development of OCS is the High-Speed Pellet Scanning System PS200C. This system is for detection of contamination, discoloration and foreign particles on transparent and opaque pellets. The PS200C is an advanced version of the PS25C and has the same features, only the throughput of both devices is different. The PS200C has a throughput of approx. 250 kg/h and is applicable, especially for the online quality control during a production process.

Pellet Size and Shape Analyser PSSA

The PSSA is a modular inspection system for the precise analysis of size and shape of transparent and opaque granules (e.g. twins, triples, dog-bones, tails, fines) for the polymer industry. The pellets are separated on a vibrating surface and transported to the measurement zone. The recorded data are stored in a test report to enable a future analysis of the results. The features of the granules e.g. size, shape, elongation, roundness, roughness and convexity can be presented graphically or in tabular form and printed as well. This system assures a continuous process pelletizer monitoring including pellet weight/count (optional).

Pellet Size and Shape Distribution PSSD

The PSSD is a modular inspection system for the rapid analysis of the size and shape distribution of transparent and opaque granules (e.g. twins, triples, dog-bones, tails, fines) for the polymer industry. The pellets are transported by the vibrating channel and are measured individually in the free fall between the camera and the light source. This principle enables the system to analyse up to 50 kg/h. The results are graphically presented as particle size and shape distribution, time history of the measurement as well as in tabular form.

Pellet Analyser PA66

The PA66 is a combination of the highly sensitive PSSD, PS25C and real Colour Measurement CM (optional). These systems are working at the same time to assure the highest quality of the polymers.
Blown Film Tower BFT300/400

The blown film towers BFT 300/400 with film haul-off, extruder and spiral die are used to produce high-quality blown film for carrying out optical and physical measurement on the film. The mechanical design corresponds to a production system in laboratory scale. All settings and configuration parameters are stored by the system (touch panel), which means that the film quality can be reproduced at any time. This is particularly important for optical on-/offline measurement, such as gels, contamination, haze, gloss, etc. Reproducible film qualities are also important for on-/offline density and additive measurement.

The tower height is electrically driven, free adjustable and can therefore be set optimally for all extruded materials.

The take-off nip rolls are driven pneumatically and the temperature is optionally controlled.

The film bubble can be stabilised with additional guiding rolls, adjustable wooden grids and Teflon-coated rolls are leading the film bubble into a flat layer film.

The guiding rolls are made of stainless steel. Some guiding rolls are special designed to prevent wrinkles.

The blown film tower is operated via a colour LCD touch panel. All parameters, e.g. haul-off speed, film tension, winding force, winder diameter, cooling air, film width, etc. can be set and stored as a configuration file.

An optical device measures the width of the flattened film and controls the diameter of the film bubble. In this way, the desired film width remains constant. The film width is recorded and shown graphically on the touch panel.

The complete operation is visualised on the touch screen.
Cast Film

Chill Roll & Winder Unit CR9/WU9

The Chill Roll & Winder Unit has been specially developed to meet the requirements of the polymer raw material producers.

The CR9/WU9 can contain an FTIR for Online Spectroscopy, Haze-, Gloss- and Thickness Measurement and they can be used in the laboratory or online, serves the production of cast film/winding blow film. The system consists of two chill rolls with controlled drive, temperature, speed several guidance rolls, haul-off station with two rubber-nip rolls followed by a central pneumatically expandable winder. The winder is regulated via the tension control.

The CR9/WU9 is equipped with a film break sensor and a detector for film direction as an alarm function. An electrostatic discharging of the winder with ionised air is available.

A speed indication for chill rolls and nip rolls is available and the winder is pneumatically expandable. The CR9/WU9 is equipped with a film break sensor and a detector for film direction as an alarm function. An electrostatic discharging of the winder with ionised air is available.
**Film Surface Analyzer FSA100**

FSA100 is a modular surface inspection system for use in laboratories and production. The film quality is assessed optoelectronically through the use of high-resolution line cameras and the appropriate illumination technology. The measurement data are stored in an inspection report so that later analysis is possible at any time.

The modular concept permits the use of different camera and illumination constellations and can therefore be optimally used for transparent and opaque films. Optimum adaptation in laboratory work and in encapsulated measuring stations is a major contribution towards quality control.

In addition to the recognition and classification of defects, the system can also be used for analysis, recording, archiving and documentation purposes. Every defect detected is transferred with the defect image to the measurement protocol together with its feature vector (position, size, shape ...).

The system can be modified exactly to suit the respective requirements.

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**Sample Tester ST4**

The Film Quality Scanning System ST4 is designed for the precise inspection of surfaces with a small area. Transparent materials such as films (PP/PE, PS, etc.), plates (Polycarbonate), glass etc. and non-transparent/opaque materials like paper, metals or textiles etc. can be examined. The system detects impurities, holes, scratches and other surface irregularities. It is suitable for laboratory use and for research and development.
The New OP5 online Rheometer

A system for plant optimisation and improved product quality

OCS have acquired the Porpoise technology and bring you the new OP5 rheometer.

The function of the OP5 is to make certified measurements of the Melt Index and/or Polydispersity of small solid polymer samples. The primary duty of these measurements is overall control of many types of polymerisation processes, to ensure that the product is made to the correct specifications. The secondary duty is Quality Control of the customer product. The OP5 is logically situated in the plant analysis laboratory, which ensures best reliability, calibration and maintainability for these important measurements.

Representative samples of each reactor (and finished product) are therefore transported to individual analysers. In simple plant configurations, such as LDPE, PS, PET and Nylon this usually means one OP5. In complex plants such as PP, HDPE and LLDPE two or more OP5 analysers would be required and in the case of powder sampling the associated analyser would have degassing and catalyst deactivation stages. Sample extraction is to be via the OCS PTS system which is individually configured to minimise reactor to analysis delay time.

Melt flow measurements are performed after the solid sample is melted and conditioned to the appropriate test temperature. In the OP5 the rapid melting process minimises any changes to the structure of the polymer and substantially avoids any shear damage, cross-linking, thermal degradation and other degradation processes. This sample preparation removes the last traces of any trapped air or gas and overall makes an important contribution to making the sample at the point of measurement fully representative of the process. In this unique way the OP5 makes control through rheology as reality.

The melt flow is regulated by a sealed gear pump, which transports a metered quantity through a shaped die which has the normal MI die L/D. The shaping of the die is to minimise the delay in the slow moving polymer near the walls, without deviating the actual rheology relationships too far from the standard MI die. Measurements of pressure and flow rate are used to derive the standard Melt Index. Many features of the apparatus are covered in the following current patents. The patent, Melt Flow determination in Polymer process, has the following grants, EU 989 45440, GB 233 4958 and US 09/622558. These patents also have integrated process control application. Systematic correlations are applied to compensate for the relationship between the OP5 die and the lab test die and test methodology thus covering both ASTM D1283 and ISO 1133 methods. Once established the corrections do require regular verification, which is supplied through the OP5 operating software. The IPR of the operations are described in the EU CTM, Registration Certificate No 002729309. The methodology of calibration and measurement gives the OP5 class leading accuracy, which can be used to certify the finished product and thus completely replace routine testing using the Lab Melt Indexers, whether manual or completely automatic. It is normal to certify these calibrations through a third party specialist, SGS, who are respected globally for such duties and have now contract approval with major polymer producers for such onerous tasks.

The OP5 measurement of Melt Index is performed in a batch process, termed a cycle. The MI result is based on a tiny part of the sample, which gives the OP5 a pin point accuracy. The result shows every small variation in the polymer product and which can be used to steer polymer reactions in a way not possible by long term averaging or less than adequate sample preparation. The delay, from reactor to measurement result, is comfortably small enough to achieve tight reaction control. The measurement qualities are of course valuable for Quality Control and will thus maximise the added value to the production.

The unique features of the OP5 equipment open up the huge opportunity process control through rheology.
Online FT-Infrared Spectrometry APLAIRS®
Replacing your QC-methods with only one technique

APLAIRS® (Analysis of PLastics by InfraRed Spectrometry). With this concept, conventional quality control methods can be replaced with only one spectroscopic technique. Additives, physical properties, co-polymer and multi-layer composition, thickness as well as degree of polymerisation can be measured simultaneously. A continuous flow of film runs through a special construction of the APLAIRS® system, which is equipped with an FTIR spectrometer and specially designed software. APLAIRS® focuses on film measurements, although infrared spectroscopy can also be applied to melted samples.

Application

APLAIRS® can be applied to a whole range of polymers, co-polymers and blends to determine the chemical composition in the resins, varying from functional group analysis to co-polymer composition anti-oxidants, UV absorbers, slip agents, stabilisers, fillers, extenders, impact modifiers, speciality modifiers, processing aids, flame retardants and any other additives the extruded film thickness, and the thickness of separate films in multi-layered structures physical properties like density, splittness, etc.
Pelletizing

Lab scale strand pelletizer consists of:

Extruder 20/250 V3, strands die, water bath and strand pelletizer with adjustable speed.
The extruder has a TFT touch panel with 4 heating zones, 4 micro processor temperature controls and temperature sensors.
- High/low- temperature alarm with driving-stop
- Alarm signal and alarm-quitting
- Torque indicator
- Torque alarm
- Rotation speed indicator 0….150 rpm
- Rotation adjustment with up/down button
- Strand die with heating, 3 mm and 4 mm diameter
- Sample hopper with “hopper empty” alarm
- 3 zone-screw 4:1 with mixing zone

Filtration Test

Filtration Test ME FT 20 according to DIN EN 13900-5

The system can determine the Filter Pressure Value FPV as well as other parameters. Furthermore rheological data can be acquired.
A sieve package can be installed behind the gear pump. For every maintenance an automatic screen changer option is available.

Following operations are possible:
- Extruder with constant rotation – gear pumps with constant rotation:
  Pressure monitoring before the sieve package
- Extruder with constant pressure – gear pumps with constant rotation:
  Continuous monitoring and full automatic measurement to determine the Filter Pressure Volume (FPV)
- The gear pump can be operated with constant pressure both, before and after the pump (itself)
Hazemeter Gamma12 according to ASTM 1003

The functional principle of Gamma12 complies with the standard ASTM 1003. The film sample which has to be measured is passed across the opening in an integrating sphere so that parallel light can pass through the sample into the sphere. The intensity of the dispersed light can be measured using a high-precision sensor by means of the dispersion of the transmitted light beam. Light beams with dispersion angles exceeding a standardised value cannot leave the sphere through the exit and are reflected by the sphere surface. The intensity of the scattered light is measured after multiple reflections within the integrating sphere.

The intensity of the total light transmitted can be determined by measuring with the sphere exit closed. The haze value is calculated from the ratio of the scattered light and the total transmitted light.

Thickness, Gloss, Haze and Colour Measurement

Glossmeter GM according to ASTM D 523/DIN 67530

The Glossmeter serves the determination of the gloss characteristics of the manufactured film. The measurement is effected by analysis of the reflected light during the running process. The Ethernet Interface permits the evaluation and documentation of the measuring results. The data exchange is realised by Modbus/TCP protocol or optional OPC server.

Thickness Measurement TM9

The stand-alone measuring device TM9 is used for the continuous measurement of the film thickness with the aid of measuring rolls. The integration of TM9 into the CR9 system is a perfect solution for the cast/blown film thickness control. The data recording is carried out by a digital calliper. The measurement data and the various functions of the film thickness control are displayed on the CR9 touch panel. The electronic control and data output can be realised by a serial interface with a modbus protocol (RS232/RS485) or alternatively by an interface 4-20 mA/0-10V.
FSP600 is a modular surface inspection system for use in production. The production quality of the material to be inspected is assessed opto-electronically. The measurement data are stored in an inspection report so that later analysis (e.g. monthly statistics) is possible at any time.

The modular concept permits the use of several cameras working in parallel so that optimum adaptation can be achieved for every problem. The system is dimensioned as a function of the production speed, the inspection width and the inspection accuracy (resolution) so that complete inspection of the entire web width is ensured.

In addition to the mere recognition and classification of defects, the system can also be used for analysis, recording, archiving and documentation purposes. Every defect detected is transferred with the defect image to the measurement protocol together with its feature vector (position, size, shape ...). The system can be modified exactly to suit the respective requirements using the comprehensive software packages.
The Pellet Transport System PTS is a continuous and automatic transportation of pellets between the production lines and measuring systems. Samples of pellets from the production line are affected by means of pneumatic sample takers. Samples are sent through aluminium or stainless steel pipes (shot peened option). The PTS consists of hopper loaders (Cyclone) with shutter valves for extruder with low and high level sensors for sampling. Furthermore a stand by tank for purge and calibration material and a 3-way switch for a starvation system is available.

The PTS is controlled with a PLC which is driven with a TFT touch panel for visualisation and control of the sampling system. The system is equipped with a digital I/O interface to the DCS for transferring status and alarms. All pipes and bends (elbows) are specified to avoid dust, angel hairs and streamers. Totally gap-free flange connections (recommended: Slip-on collars and loose flanges with projection and recess). A de-dusting device for removing dust and streamers etc. is an option.
Turnkey laboratory services

OCS-lab provides total turnkey laboratory packages and utilities for the plastic industry for any licence, fully adapted to the demands of our customers.

Many aspects are involved in planning a total turnkey package. For any plastic laboratory project OCS-lab is compiling a tailored package in compliance with client. After several iterations with subject matter experts of our clients a proposition is made. After the announcement of the tender by the customer, OCS-lab prepares the related documentation and calculates a total price for a bid to the customer.

During the planning process, it is very convenient to use the visualisation tools allowing both parties to simulate how the final configuration looks. OCS-lab has experts in the team who can work with state of the art software packages for this purpose.

Benefits

- One contact – One line of communication
- One company is liable
- Efficient and fast
- Cost-effective and high quality
- A contractor with experienced people who knows the plastic industry
- A partner at any time and any place
- A global player with a global network
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Turnkey Solutions for the Polymer Industry

Laboratory
- Measuring Extruder
- Pellet & Powder Analyser
- Melt & Liquid Analyser
- Chill Roll & Winding Unit
- Blown Film & Cast Film Lines
- Film Quality Testing Systems
- FTIR-Spectroscopy
- Gloss, Colour, Haze & Thickness Measurement
- Pellet Transport Systems
- Online Rheometer

Production
- Online analyser house
- Extruder for small-batch production
- Wide Web Inspection