Optical Control Systems

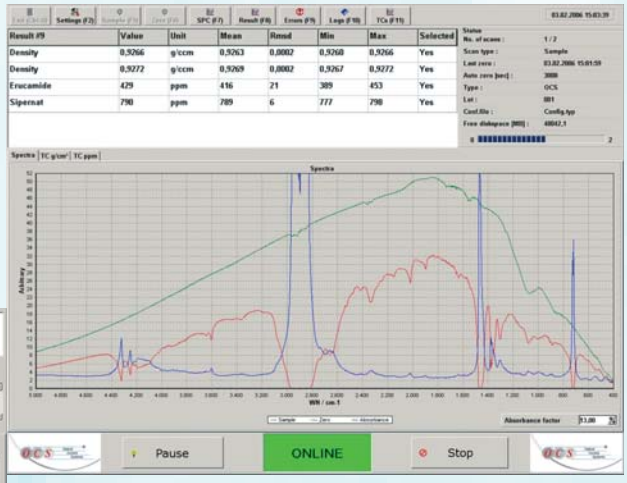
The Solution for the Polymer Industry

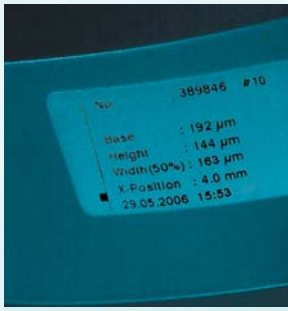
On-Line FT-Infrared Spectroscopy

APLAIRS®

The Original by OCS

On-Line FT-Infrared Spectroscopy





Replacing your Quality Methods by one single technique

APLAIRS® (Analysis of Plastics by InfraRed Spectroscopy) is a spectroscopic technology, applied in the modern plastic industry, to measure real time additives, co-monomer composition as well as some chemical properties during the production of the base resin. For state of the art process as well as quality control, the Aplairs system, is an absolute requirement in modern plastic production facilities. With a better precision and a faster analysis time, this single technology replaces most of the conventional off-line quality control (QC) methods. For process control, in addition to melt index and in homogeneity, the Aplairs system generates real time very useful complementary analytical data. For example, for products with a similar melt index and a different additive package, Aplairs will be able to accurately monitor type changes. In addition, the technology offers tools for monitoring real time co-monomer incorporation. Physical property such as density in polyethylene can be determined real time, with a better precision than the off-line column gradient or Archimedes methods. The technology provides early warning in erroneous master batch preparation, which in many cases avoids huge customer claims. As this technology replaces many conventional QC methods, savings in labour cost are considerable. The Aplairs system is fully automated and no people are needed to run the system.

Measuring principle

A continuous flow of cast or blown film runs through a special Infrared sampling section of the APLAIRS® system, which is equipped with an FTIR spectrometer and controlled by dedicated software.
APLAIRS® focuses on film measurements, although infrared spectroscopy can also be applied to melt samples. Measuring in the film has more advantages than measuring in the melt:
Films are closer to the end product and for that reason a direct link is made with standard QC Analysis.
Physical properties not only depend on chemical components but also on the morphology of the resin.
The morphology and chemical information concealed in the spectra can be abstracted by APLAIRS ® and linked with physical test data.
Thickness of films can be accurately determined. In addition, it is possible to determine the composition and thickness of different layers in co-laminates.
Other analytical techniques such as Gloss and Haze measurements can be far easier linked to a film line, making the assembled configuration inexpensive.

The APLAIRS® software offers many possibilities

The Aplairs software is an essential part of the technology package. It offers sophisticated tools for the analytical specialist to develop tailored calibration models, as well as easy to understand and fool proof menus for the operators.

With the calibration model development package regions in the spectrum can be selected and processes to such an extent that relevant multivariate data is correlated with QC data. By incorporating a selection of so called calibration spectra of samples with known QC data, the relevant spectral data is abstracted and mathematicaly pre-processed and linked with the QC data to form calibration models. These calibration models can be used in the real-time mode to predict the relevant QC data of the specific product.
During the real-time analysis various QC parameters are displayed on the computer screen and history data is available for process or quality control.

In many applications the QC data is sent to the process computer allowing panel operators to follow the process and quality people to follow the quality of the process. Depending on customer requirements the QC data can be further processed to LIMS (Laboratory Information Management Systems) for the generation of quality reports.

If required spectral data can be stored during upsets or any defined process, allowing trouble shooters to research certain events.
During standard operation the software is monitoring many features in the background and if desired the software can trigger alarms if certain events require special attention or operator intervention.

Applications

APLAIRS® can be used for the following applications:

- Chemical composition of the material- from analytical functional groups to analysis of co-polymer composition
- Determination of additives, like antioxidants, Slip agents, UV-Absorbers, Stabilizers, fillers, processing aids or other
- Determination of the film thickness for a single- or a multi layer
- Determinations of the density of the material like for example the density in polyethylene

The basic principles on which APLAIRS® is based:

- Reliable, robust and extremely precise FTIR-spectroscopy for quality control in an industrial process environment
- Enhanced processing capabilities by the exploitation of state of the art hardware FFT processing
- Full automated computer control of spectral acquisition, background recording, instrument control performance monitoring, alarming and computer interfacing with process host
- Modular Quality Analysis. Conventional as well as multivariate based analysis can be applied and any customer specific analysis can be incorporated in the software
- Configuration of user specific product types and related time resolved statistical processing with flow chart display for process monitoring and control

Modular Quality analysis- and reporting features

The technology offers a platform for adaptive quality control and the QC parameters to be determined are totally dependent on the desire of the customer. Once a certain QC parameter prediction has been developed others can be added on without the investment of any hard or software. For example if one has developed a QC prediction calibration model of an additive like Calcium Carbonate, a next additive can be added on and so forth.
There are many customers who have established a whole range of QC predictions with one APLAIRS unit, i.e. additives like Euricamide, Oleamide, Talcum, Calcium Carbonate, Calciumstearat, Silicium Oxide, PEPQ, Irganox, Irgafos, etc, but also chemical composition like, Attacticity-, Ethylene- and Carbonyl content as well as physical properties such as density on parameters like thickness. There are examples of QC calibration predictions of more than 20 QC parameters with one instrument.

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Economical impact

Considering the versatility of the technology, it is obvious, that one investment will pay off big time if many QC parameters are incorporated and hence replacing laborious off-line QC methods. The APLAIRS system with its vast field of applications has been applied in many fields: LDPE, LLDPE, HDPE, PP, ABS, PS, PET, EVA, PC etc. Especially in the production environment the instrumentation can really make the difference in terms of quality monitoring. The impact is tangible in many fields. With the technique there will be less customer complaints, the quality of the product will be more consistent, type changes can be followed with greater ease, extra eyes are provided for process control and safe guarding of various processes, labour cost is reduced significantly and the technology also provides a powerful tool for root cause analysis. Typically the investment of one APLAIRS® unit is paid off in less than one year.