AddiMet ™

On-line Polymer and Additives Analysis

INTRODUCTION

AddiMet™ is a complete and flexible approach to the on-line analysis of polymers and additives. It is modular in design allowing the system to be optimally configured for the application. UV options provide the high sensitivity for the measurement of low level antioxidants e.g. Irganox®, Irgafos® and BHT (this cannot be done in the NIR). The NIR option allows the determination of bulk composition and prediction of physical properties of the polymer matrix. Several of these options can be cost effectively combined into a single system.

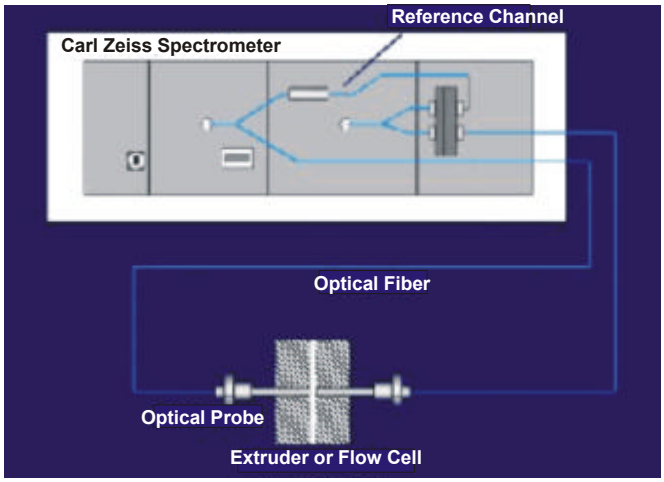

Figure 1: On-line analyser

THE ANALYSER

The System consist of a Carl Zeiss MCS 500 photodiode array UV/visible spectrophotometer which is interfaced to the process via optical probes and optical fibers. A PC running a dedicated software package written in LabVIEW™ controls the spectrophotometer. *Charm Works*™ Partial Least Squares (PLS) tools are embedded in this application in order to predict the additive concentrations. The MCS 500 Carl Zeiss modular spectrometer is the heart of the analyser system. The unique design of the spectrometer ensures reliable measurements in the harshest industrial environments. The analysis is made directly in the process stream (melt) using optical probes. These operate at up to 10,000 psi (660 bar) and over 250° C and can be installed within a process rheometer or a flow cell. A fiber optic connection between the probes and the spectrometer enhances the flexibility of the system.

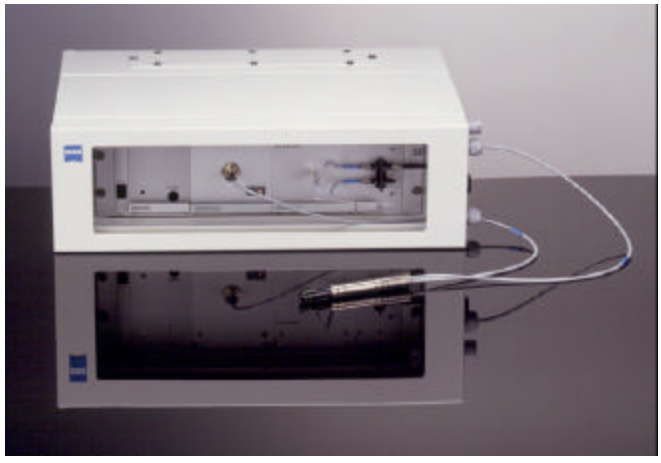

Figure 2:
MCS 500 series

THE BENEFITS

- Analysis time greatly reduced
- Tighter control of blending process is achieved
- Reduced wastage
- Customised installation

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THE SYSTEM

Probes

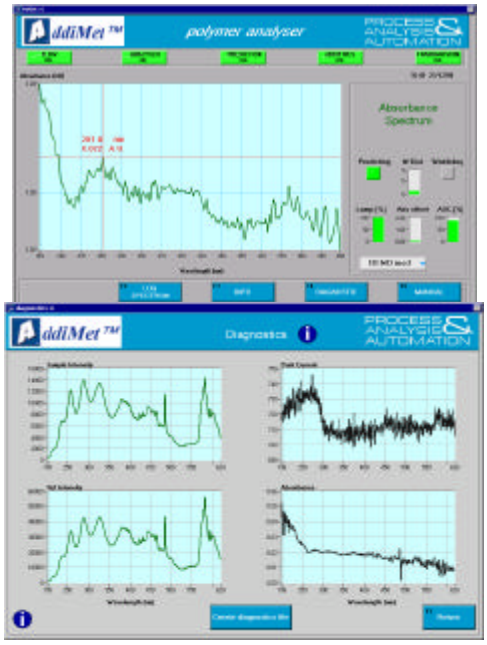
Maximum operating temperature
Operating pressure
Optical fiber
Spectrophotometer
Computer

Digital interface

Polymer Melt Probes mounted in a melt measurement platform ***(Rheometric Scientific).***
250°C
in excess of 10,000 psi.
600 µm silica core
Carl Zeiss MCS UV series
at least a Pentium 166 MHz PC with 24 Mbytes of RAM running Window NT
the computer is equipped with a National Instruments interface card, enabling the performance of the system to be monitored by the process control system and to generate local alarms.

THE SOFTWARE

AddiMet™ software controls the spectrometer, analyses the data and communicates with process control system (all industrial communication protocols supported). AddiMet™ uses the PLS (Partial Least Squares) algorithm to predict in real time the concentrations of antioxidants (simultaneous multicomponent analysis) or the physical properties of the polymer.
The PLS calibration set is obtained from liquid chromatographic analysis on samples removed from the extruder. About 30 samples, evenly covering the concentration range, are required. The exact number of samples depends on the number of additives to be analysed and the quality of the reference analytical data. The model can be upgraded and optimised by adding new training samples at anytime.The use of PLS enables simultaneous on-line analysis of multiple additives. Thus further reducing analysis time.The composition of the polyethylene melt is inferred in real time rather than waiting several hours for off-line chromatographic analysis. The measurement period is typically 10 seconds. The software on the associated PC processes the spectra on demand and passes the additive concentrations to the process control system.



AddiMet™ software is licenced exclusively to Carl Zeiss by Process Analysis and Automation Ltd

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