Chemical
Perspectives in Liquid Process Analytics

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News

INGOLD
Leading Process Analytics

O_2 Measurement
for Inertization Control

For safety reasons, some chemical reactions take place in an inert gas environment where the amount of oxygen present is tightly controlled. The METTLER TOLEDO gas-phase measurement system showed the best price/performance ratio in comparison to others in a polymeration reactor application.

Our customer, an international leader

One of the world leaders in specialty chemicals maintains manufacturing facilities in Brazil producing, besides performance and process chemicals, a range of different detergents. These are based on anionic and cationic surfactants and polymers, as well as bleach activators. The products are used in many industries in countless applications.

Measurement of oxygen concentration on inertized atmosphere

The application in question takes place in a stainless steel reactor, where certain organic compounds react. The headspace of the reactor must be filled with inert gas, i.e. nitrogen, as there is a clear explosion risk. An oxygen measurement system was installed to keep the situation under control.

In the reactor headspace itself, besides the nitrogen (around 94%), some traces of volatiles organics coming from the liquid phase, (around 2% isopropanol) are also in the measurement media.

The customer used to measure the oxygen concentration in the inertized atmosphere by using equipment from another supplier. The measurement cell, however, was very difficult to maintain reliably, and its installation needed an awkward sample system. Additionally, some components of the measured gas stream interfered with the measurement result.
The measurement media is at 50 °C (122 °F) and at atmospheric pressure. The maxi-

METTLER TOLEDO

mum oxygen concentration allowed in the mixture of gases in the headspace is 7% vol.

Customer's expectation

The customer made clear statements, requesting easy maintenance possibilities and above all drastic reductions in replacement costs.

METTLER TOLEDO solution and expertise

Based on the application features itself, an oxygen system was specified. System components were installed at the vent of the polymerization reactor, constantly inertized. They will enable prevention of the creation of a hazardous atmosphere caused by H_2O_2 decomposition in the process.

The complete system consisted of the following METTLER TOLEDO products:

- InPro 6800 oxygen sensor
- O_2 transmitter 4100 e / 2XH
- InTrac 777 e retractable housing

The InPro 6800 sensor with gas-phase oxygen membrane was tested for one month. The system performance fulfilled all process requirements within the set test period. Due to this performance, the customer purchased the complete oxygen measurement loop.

Since the measurement is related to the reactor safety condition, the oxygen sensor was mounted in a retractable housing InTrac 777 e that allows to test the system response time and its accuracy, by injecting air (21% vol. of oxygen) into the housing washing chamber when the sensor is retracted. Such mounting also allows easier sensor maintenance and cleaning.

Customer benefits

The technical advantages of the products selected for this application fully met up to the requirements specified by the customer. Besides all the technical advantages offered by the METTLER TOLEDO system itself, the customer now no longer needs a sample conditioning device and its replacement parts or any special measuring reagents. The customer will also experience a significant reduction in process downtime. It is important to point out that the investment in the new solution will pay-off over a period of about one year.

Coming opportunities

METTLER TOLEDO Process Analytics Brazil has already sold two systems as described above to this customer. Whereas the first system has already been successfully implemented in the production process, the second one will be fully installed at the end of 2006.

Due to the successful implementation, there are four further measuring loops whose measurement cells are also mounted in a sampling system. Even if they are satisfied with the system performance so far, the customer is concerned about the maintenance and replacement costs which will arise in the future. Therefore, and because the METTLER TOLEDO systems show completely new, very satisfying performance, there are plans to replace these old systems from a competitor by those described in this article.

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The successful O_2-measuring system.

InTrac 777e. InPro 6800. 4100 e O_2 transmitter.

Oxygen Control in Gas Phase for Safely Recovering Flammable Solvents

Fast response, high reliability and minimal downtime were paramount for measuring gas-phase oxygen in the headspace of metal barrel shredders and in a thermal recovery unit.

A dynamic US company in the waste management industry

Our customer is an innovative waste management company centrally located in Arkansas, USA. It manufactures fuel derived from waste oils and solvents that is used as a secondary fuel source to replace coal and natural gas in cement kilns.

Oxygen measurements in the gas phase

The facility has two different applications of gas-phase oxygen measurement; in the headspace of metal barrel shredders and in a thermal recovery unit.

InPro 6800.

Oxygen measurement in the headspace of metal barrel shredders

Most of the waste solvents arrives at the facility in metal 55 gallon drums. The bulk of the liquid is drained from the containers and collected. The drums are decontaminated from residual organics using further heat treatment which first requires the metal containers to be shredded into manageable pieces (see figure).

The shredders are hoppers which have a large rotating roller with steel "teeth" that chops the barrels into easy to handle pieces. Given the likelihood of sparking with the metal-to-metal contact, combined with the fact that flammable solvents may be present, it is important that the system be operated below critical oxygen levels. Without sufficient oxygen, fire or explosion is not possible even though fuel and an ignition source are present. This form of explosion prevention is called "inerting".

INGOLD solution with gas-phase oxygen system controls shredder

The drums are loaded through the top of the hopper, the top is then closed sealing the system. Now carbon dioxide purge gas is applied. As the oxygen-rich air is replaced by the carbon dioxide, the oxygen concentration in the vessel is continuously monitored using a Mettler-Toledo Ingold gas-phase oxygen system. The shredder may only be activated once the oxygen level reads below 8% oxygen. Accurate readings of oxygen clearly play a critical role in the safe operation.

InPro 6800 meets tremendous challenge of process

While the safety aspect is paramount, system reliability and rapid speed of sensor response directly impacts process efficiency and throughput. Delays due to sensor response time, extend the batch operation cycle time, reducing process efficiency.

The successful measuring system

The fast response of the InPro 6800 eliminates this problem. The high reliability of the sensors also minimizes downtime resulting from sensors being out of service. Each of the six shredders is equipped with a METTLER TOLEDO Ingold InPro 6800 gas-phase oxygen sensor and a 4100 e Oxygen transmitter. In addition, 3 additional sensors and transmitters are available as "hot back-ups" ready for immediate use, eliminating process downtime even during routine maintenance.

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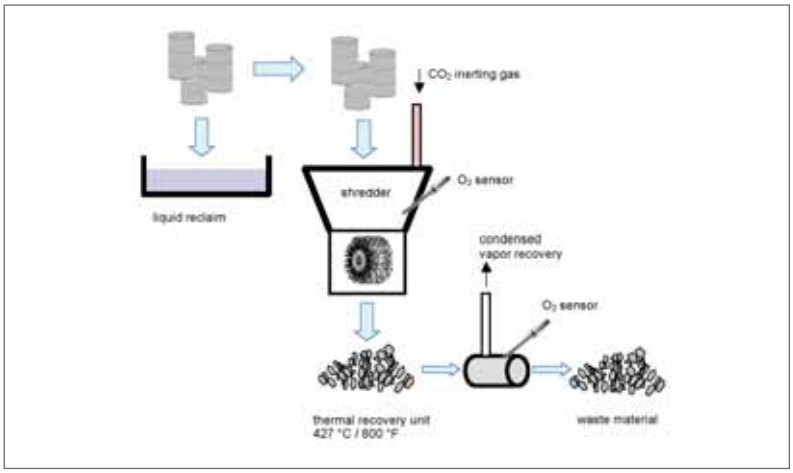


Intelligent Sensor Management (ISM®) Systems:
Advanced Diagnostics for Efficient Maintenance

ISM systems can offer higher productivity, less downtime, better operational safety, lower operational costs and improved profit margins.

Intelligent sensors – a must for any modern process plant

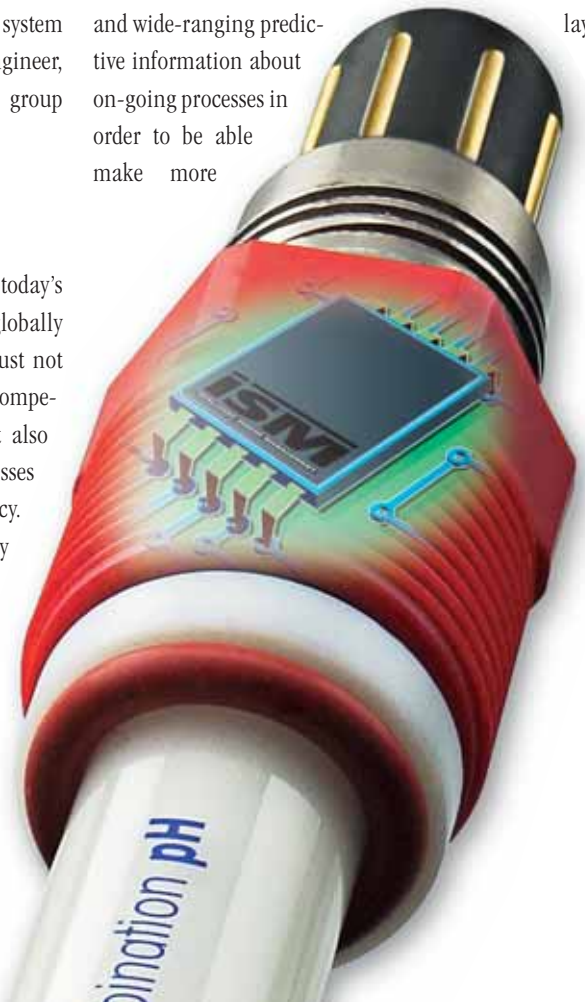
The marketplace is full of instrumentation advances that are either smart or intelligent. Smart sensors store information, and intelligent sensor management systems use information in an adaptive way. The focus of these new instruments is not so much on detection technology but on communication, interrogation and performance-status features. This is a result of the fact that process analytics companies are driven by their customers' demands for additional information. It's the impetus of these demands and how an intelligent sensor management system meets them that the process engineer, plant manager and maintenance group members need to understand.

Maximization of quality and minimization of costs

The main challenge faced by today's process industries is to remain globally competitive. To do this, a firm must not only establish a competitive core competency in a given product area, it also must continually improve its processes in order to retain that competency. This means maximizing quality throughput and minimizing cost with the existing plant infrastructure. This often causes situations where a 30-year-old plant, for example, competes globally with a 2-year-old plant. It is estimated that equipment failure can account for up to one-third of the costs arising from unscheduled industrial plant downtime, and that 25 percent of a plant's overall maintenance budget is dedicated to maintaining field instruments. In the light of this, regular upgrading of equipment, and in particular of the instrumentation take on special significance.

More useful information allows better decisions

The main demands from process industry plant engineers and plant managers on process analytic companies are then clear. What is needed is more useful and wide-ranging predictive information about on-going processes in order to be able make more timely and purposeful decisions. Companies want to be in a position to proactively manage their processes to enable them turn out their products more efficiently.



What are the cost drivers?

Traditional information gathering and maintenance practices can be expensive. A conventional "loop" or a measurement point such as pH can cost a plant up to four times the initial acquisition cost over its lifetime. Costs driving this include maintenance, consumables and downtime. In some industries, downtime can mean millions lost on a product that has been delayed, is out of specification or entirely gone to waste. Maintenance and consumable costs are a self-fulfilling problem in that the very presence of the equipment and the fear of downtime justify having high maintenance budgets and elaborate schedules to "monitor" equipment.

ISM helps to control the cost drivers

An intelligent sensor management system (ISM) can alleviate this situation, provided it has the following attributes:

- Ease of operation: Workers must be able to understand the instrument. A system too complex to implement does not get used.
- Safe operation: To ensure process safety, an intelligent system can permit use only of a specific authorized sensor type. For personal safety, exposure to hazardous environments can be minimized by using pre-calibrated, self-configuring sensors.
- Self-configuring: This feature provides communication between transmitter and sensor, including connectivity status, sensor identification and calibration data. A smart sensor allows access to this information upon request, while the intelligent sensor management system displays the information immediately on connection.
- Self-assessment and advanced diagnostics: Using pH measurement as an example, these instruments are capable of monitoring sensor slope, zero point, reference impedance, glass impedance and response-time monitoring. In addition, ISM systems monitor operating time, process temperature and chemical concentration exposure. They use all the above information in an adaptive manner to establish sensor wear and automatically adjust calibration timing. Smart sensors are historic, intelligent sensor management systems predictive and adaptive.

Open communication enables flexibility

Intelligent sensor management systems should also be expandable and compatible with industry standards. This means they must utilize an open communication protocol such as IEEE 1451.4 and utilize a widely acceptable connection system such as VarioPin connectors. The last thing you want to do is lock your plant into a proprietary installation.

Practical benefits of ISM sensors

ISM systems yield benefits at many organizational levels. For example, the maintenance group can install a factory-calibrated sensor "out of the box." Further calibrations can be done in a controlled laboratory environment and automatically downloaded in the field. Frequent "just-in-case" calibrations can be replaced by timely "as-needed" calibration. Sensors are discarded only when the empirical "sensor wear" indicator says they should be discarded. Furthermore, an aging electrode can be removed prior to a critical process event. Process engineers benefit from automatic transmitter configuration of sensor settings, quick troubleshooting ability, continuous reference check in the case of pH, and the recording of peak sensor temperature.

Economic benefits

Intelligent sensor management systems mean higher productivity and less downtime due to quick setup, troubleshooting capabilities and adaptive sensor diagnostics. They can also provide better operational safety due to the "plug-and-measure" concept, electronic documentation and audit trail links, which result in lower overall operational costs and improved profit margins.

Maintenance and consumable costs are a self-fulfilling problem in that the very presence of the equipment and the fear of downtime justify high maintenance budgets. An intelligent sensor management system can alleviate this situation.

"It is estimated that equipment failure can account for up to one-third of the costs arising from unscheduled industrial plant downtime".

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Xerolyt® EXTRA Electrodes Optimize pH Operating Costs in PVC Production

A large chemical plant in Germany has been using Xerolyt pH electrodes in various process steps. Important is the very low maintenance requirement: no pressurization of the electrolyte is needed and no diaphragm contamination occurs.

The international PVC market

The PVC industry is emerging from several weak years in terms of profitability. Economic growth of 2.8 % per annum from 1999-2004 is forecast to accelerate to 3.6 % from 2004 through 2009. Global PVC demand recovered in 2004 and is forecast to continue to grow at a rate of 4.1 % per year through 2009. China will be the key country for world demand and supply issues. China is planning on adding most of the world's new PVC capacity over the next few years.

PVC production process

PVC, first synthesized in the laboratory in 1903, is made through polymerization of VCM (vinyl chloride monomer) which is made from ethylene and chlorine. In two simultaneous processes, 1.2-dichloroethane (EDC) is produced. Through "direct chlorination", EDC is produced from ethylene and chlorine at approx. 60 °C (140 °F) in the presence of an iron compound catalyst. In a cracking unit EDC is converted to VCM under formation of hydrogen chloride HCl. The generated HCL is fed to the "oxichlorination" process where it reacts with ethylene to EDC at a temperature in the region of 250 °C (482 °F), in the presence of a copper compound catalyst. After purification through distillation, the VCM can now be further processed to PVC.

Main measuring points

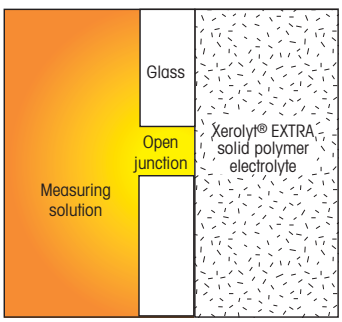
Xerolyt EXTRA electrodes are used in several process steps: In the quench tower, EDC and process water are scrubbed with recycled process water and caustic soda. After decanting the EDC receives further caustic treatment. The process water is recycled as scrubbing liquid. The polymerization of VCM to PVC is carried out in water and pH is an important parameter in obtaining the required product quality. Cooling water, acid neutralization and sludge incineration are also exclusively equipped with METTLER TOLEDO pH electrodes with Xerolyt EXTRA reference system.

Our long-standing customer places special value on the use of the same type of electrode at the measuring points throughout the company in order to ensure first-class operating efficiency. A further requirement on the electrodes for the various measuring points was very long operational life under the following conditions:

- Measuring range: pH 2…12
- Temperature range: 20…100 °C (68…212 °F)
- Pressures: up to max. 5 bar (72.5 psi)

Enhancement of process safety

In order to enhance process safety, thirty measuring points were each equipped with two pH electrodes redundant. This step has, apart from the safety aspect, the advantage that recalibration is only very seldom necessary. The great advantages of the METTLER TOLEDO pH electrodes using a Xerolyt EXTRA reference system were confirmed. Despite the harshest of conditions, where the open reference system is in direct contact with HCl, caustic soda, EDC and trichloroethane (side product), the electrodes performed flawlessly and achieved an operating life of between a half and one-and-a-half years without any significant maintenance effort. The electrodes supplied to this customer have, over the period of many years, proved their particular suitability for measurement tasks in especially problematic media in the chemical industry. Their exceptionally high reliability in applications of the kind described here takes on an aspect of increasing importance when seen in the light of today's ever stricter requirements surrounding process safety.



Xerolyt EXTRA, a development of METTLER TOLEDO

This new, high-performance, low-maintenance electrode InPro 4260 containing Xerolyt EXTRA, is a further development of the former InPro 4250 PLUS electrode.

Convincing benefits of InPro 4260

- For most difficult industrial environments.
- No diaphragm fouling in applications where sticky media, solutions with high particle content, or sulfide-bearing solutions are present.
- Very low maintenance requirement.
- No loss of electrical contact between the reference and the media.
- No erroneous pH readings due to contamination of the reference with the process solution.

A good design of the reference system, together with the right composition of the polymer behind the open junction, can make the difference.

Intelligent Sensor Management (ISM®)

pH electrodes with integrated ISM functionality allow "Plug and Measure" and Advanced Diagnostics. ISM simplifies the installation, handling and maintenance of measurement equipment.

pH Range:	0 – 14 pH
Temperature:	0 to 130 °C (32 to 266 °F)
Pressure:	1 to 16 bar at 25 °C, 8 bar at 130 °C 0 to 217 psi at 77 °F, 101 psi at 266 °F
Plug Head:	VP (IP 68),
Reference System:	Ag/AgCl
Type of Junction:	Open junction with direct contact to media
Reference Electrolyte:	Xerolyt EXTRA (patented)
Temperature Sensor:	Pt100 or Pt1000
Certificats:	Quality Certificate, ATEX: EEx II 1/2 G IIC T6/T5/T4/T3, FM: IS Cl. I, II, III, Div 1, GR ABCDEFG/T6

www.mt.com/pro-pH

Acid neutralisation.

Original INGOLD Accessories
Keep your Measuring Systems Running

METTLER TOLEDO not only provides complete measuring systems to control parameters such as pH/ORP, dissolved and gaseous oxygen, CO_2, conductivity and turbidity, it also offers you a comprehensive and well-balanced package of accessories.

pH and ORP Accessories

METTLER TOLEDO offers a wide selection of pH buffers, electrolytes, cleaning and storage solutions to facilitate operation and maintenance of its high-accuracy pH measurement systems.

Oxygen Accessories and Maintenance

To maintain the membrane integrity of oxygen sensors, kits of multiple membrane types, including membrane body, electrolytes and O-rings are offered.

Continued Support

Many customers still rely on our previous generations of products. We are committed to continue to provide maintenance materials, service and technical support for all of these products.

For more information, we invite you to visit:

www.mt.com/pro-service

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