Chemical
Perspectives in Liquid Process Analytics

20 News

INGOLD
Leading Process Analytics

80 % Reduction in Sensor Maintenance
with Process Tolerant pH Electrode

In chlor-alkali processes, maximizing productivity is hampered by the unreliability, high maintenance demand, and short lifetime of traditional pH probes. For a Sino-German chemical company, a pH electrode designed specifically for chlor-alkali use has reduced sensor maintenance to a minimum.

Important compound

Cyanuric chloride is used as an intermediate in the manufacture of pesticides, dyestuffs, optical brighteners, and pharmaceuticals. More than 100,000 tonnes of the compound are manufactured annually.

The world's largest producer is Evonik Industries Group, Germany's third largest chemical company. Evonik Industries Fine Chemicals Co., Ltd. is a Sino-German joint venture set up between Evonik and Yingkou Sanzheng Fine Chemical Co. At their plant in Yingkou City, Liaoning Province, China they produce cyanuric chloride as well as the main raw materials for its production: sodium cyanide and chlorine.

pH control is essential in chlor-alkali processes

In respect of chlorine production, Evonik employs the membrane cell chlor-alkali process. Here, aqueous sodium chloride (brine) is electrolyzed in large cells to produce chlorine gas at the anode and, as co-products, caustic soda and hydrogen at the cathode. Anode and cathode are separated by an ion-exchange membrane that prevents the chlorine being reduced by the hydrogen and forming chloride and hypochlorite ions.

pH value is extremely important in a number of steps throughout the membrane cell process. Purity of the brine entering the electrolysis cells has a great bearing on process yield. By adding various salts as precipitants and increasing the

METTLER TOLEDO

pH to between 10 and 12, impurities such as sulfates and metal hydroxides can be extracted. On the anode side of the cells the reaction takes place under acidic conditions (pH 3 – 4). Although a lower pH would improve yield, it would damage the cell membranes, which are expensive to replace. The depleted brine that leaves the cells contains chlorate. Through a destruction process at pH 2, the chlorate is converted to chlorine and extracted.

pH electrode explicitly for chlor-alkali use

The diaphragm on the electrodes that Evonik was using for pH monitoring were being clogged by brine crystals, necessitating regular and time-consuming sensor cleaning and calibration. In addition, chlorine was diffusing through the diaphragm, affecting measurement reliability and reducing sensor lifetime. Evonik engineers were anxious to find a reliable, low-maintenance system that would not suffer from these issues. On one of the cells, METTLER TOLEDO installed a test system using our InPro 4850 i, an electrode developed specifically for use in chlor-alkli processes. A number of features make it the ideal choice.

Dual-membrane electrode

The sensor features two separate glass membranes. The first is a sodium-sensitive membrane which is charged by the sodium ions in the brine. As the sodium concentration in chlor-alkali electrolysis cells remains fairly constant, the InPro 4850 i uses the brine as a reference. The second glass membrane is sensitive to pH and operates in the same way as those found on most pH electrodes. By measuring the difference between the potentials of the two glass membranes, the pH of the solution can be accurately determined.

The sodium reference system is hermetically sealed; there is no diaphragm, therefore the possibility of sensor clogging and poisoning, and the consequent need for frequent cleaning and calibration, is eliminated.

InPro 4850 i
pH electrode

Digital signal

Other dual-membrane sodium / pH electrodes are available, but they suffer greatly from electrical interference. Combined, the two glass membranes have a very high impedance. With the added impedance of the cable between the sensor and transmitter, touching or simply approaching the system can create a change in the output measurement. And the longer the cable, the worse the effect.

The InPro 4850 i communicates digitally with its transmitter. Being digital, the output signal from the sensor is always 100 % stable and arrives at the transmitter unaffected by electrical interference, cable length, or moisture in the environment.

Intelligent Sensor Management

The InPro 4850 i is one of METTLER TOLEDO's Intelligent Sensor Management (ISM) sensors. All ISM sensors transmit a digitized signal to ISM transmitters; however, digital communication is not the only advantage of ISM technology. Plug and Measure functionality provides fast and simple measurement point start-up. Advanced predictive diagnostics tools offer real-time data on sensor "health" so that any corrective actions can be made before measurements are affected.

Substantial drop in maintenance

The test system at Evonik operated very successfully. The combination of the process-tolerant dual-membrane design, and digital signal and other features of Intelligent Sensor Management has reduced sensor maintenance by around 80 %, and has also improved process performance. Such is Evonik's satisfaction that they are planning to replace all their existing chlor-alkali pH electrodes with the InPro 4850 i.

Find out more about the InPro 4850 i at:
► **www.mt.com/InPro4850**

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Safer Cyanide Production

Digital Sensor Technology Reduces Risks

Sodium cyanide is an important compound for the gold mining industry. But the hazardous production environment means personnel exposure time must be minimal. Thanks to METTLER TOLEDO technology, pH electrode exchange only takes a minute.

Leading sodium cyanide producer

Despite their toxicity, cyanides are widely used in the manufacture of many everyday goods including vitamins, cosmetics, and even table salt. It goes without saying that production of cyanides must be carried out under very strict conditions to protect staff and the environment.

Sodium cyanide is used during the electroplating of precious metals. Cyanco is the leading supplier of sodium cyanide to the gold mining industry in the United States and Canada. In addition to two plants in Nevada, the company operates a terminal at Cadillac, Quebec to serve customers in the growing market in Eastern Canada. Cyanco has been a leader in the development and implementation of the International Cyanide Management Code (ICMC) and is represented on the Industry Advisory Group to the International Cyanide Management Institute. All of Cyanco's facilities are ICMC certified.

Hazardous process

The precursor to sodium cyanide, hydrogen cyanide, is produced by Cyanco using the Andrussow oxidation process, in which methane and ammonia react in the presence of oxygen over a platinum catalyst. pH is used to monitor and adjust final cyanide product levels for optimal reaction in gold extraction.

Maintenance of pH electrodes used in the hydrogen cyanide process is a time-consuming and dangerous procedure and requires full donning of Personal Protective Equipment (PPE) including respirators, to protect operators from cyanide poisoning.

M400 transmitter

ISM

InPro 4260 i
pH electrode

Calibration in a safe environment

Cyanco had been using METTLER TOLEDO's InPro 4260 pH electrodes and 2100 e transmitters successfully for many years, but is always interested in advances in analytical measurement technology that can improve its product quality and, more importantly, protect employees' health.

For this reason, Cyanco has made the transition from the above mentioned system to one comprising an M400 transmitter and InPro 4260 i electrode. The "i" in the sensor's name denotes that it features METTLER TOLEDO's Intelligent Sensor Management (ISM) technology. ISM-equipped sensors carry a microprocessor in the sensor head that makes possible a number of very valuable features. For Cyanco, the most important of these is the ability to calibrate sensors away from the process in a safe environment. Using standard pH buffers and a USB cable connected to a PC running METTLER TOLEDO's iSense Asset Suite software, Cyanco technicians are able to accurately calibrate the InPro 4260 i in a lab where PPE is not required.

Fast, simple sensor exchange

When electrode exchange is needed, an operator wearing PPE takes a pre-calibrated probe into the production area, removes the old electrode and connects the pre-calibrated one. The Ex-approved M400 transmitter immediately recognizes the electrode and configures itself accordingly. This Plug and Measure feature means the system is ready to measure in a matter of moments and operators can leave the production area having spent a fraction of the time there that they did when the non-ISM systems were in use.

Predictive maintenance

Sensor calibration is not the only feature of ISM that attracted Cyanco. ISM systems incorporate advanced predictive diagnostics tools that are displayed on the M400 transmitter and iSense software. These tools inform operators when sensors will need cleaning, calibration or exchange. This allows maintenance to shift from a regularly scheduled or reactive process, to one where tasks can be planned in advance. This ensures that the electrodes in use are maintained at peak operating condition, safeguarding process reliability and product quality.

Additionally, to simplify the control process, Cyanco plans to implement the PID control on the M400 in the near future for acid and caustic feeding during production.

Lower operating costs

The switch to ISM technology has reduced operator exposure to a hazardous environment and improved production processes, resulting in greater operational safety and significant cost savings.

If you want to improve safety and reduce costs at your plant, go to:
▶ **www.mt.com/ISM**

InPro 6800G

More Time for Process Optimization
Thanks to Carefree Oxygen Monitoring

The potential for explosions during the production of dye intermediates necessitates strict oxygen control. High-performance systems from METTLER TOLEDO give a Chinese producer worry-free monitoring, allowing them to concentrate on their processes.

Advanced production facility

In 2006, three Chinese chemical producers, Zhejiang Dibang Chemical Co., Ltd. Zhejiang Runtu Corporation and the Zimmer Chemical Group Co., Ltd. jointly developed a plant for the production of dyes and dye intermediates.

Located in China's Zhejiang province, the facility uses state-of-the-art production equipment and manufacturing processes. Close attention is paid to ensuring production is safe for plant employees as well as being environmentally friendly.

Inert atmosphere is required

At the plant, the production of dye intermediates involves the reaction of potentially explosive substances. To minimize the risk of explosive conditions developing, empty reactor vessels are inerted with nitrogen to an oxygen level of less than 5 % Vol. before process materials are injected. Throughout the inerting and reaction processes, sensors monitor the oxygen level in the reactors.

Plant engineers used locally produced oxygen monitoring systems but found that the sensors could not tolerate the 60 °C temperature and 5 bar pressure conditions and had to be regularly replaced. In addition, the deployed transmitters could not be configured with pressure compensation. Because of this failing, engineers were never certain of the O_2 level in the

reactors and would continue to feed nitrogen to the vessels without knowing if it was necessary.

Time spent on maintaining the oxygen measurement systems and preserving inert conditions in the reactors meant engineers could not concentrate on more skill-intensive tasks.

InPro 6800 G oxygen sensor

Durable oxygen measurement systems

METTLER TOLEDO was asked to provide a solution that would meet all the requirements of condition tolerance, and would also allow pressure and temperature compensation. Four systems using InPro 6800 G oxygen sensors were installed on the reactors.

As these sensors do not require any gas sampling or conditioning equipment, they were mounted within the reactors' headspace, directly where the vital measurements are required. The InPro 6800 G is designed to operate reliably in temperatures up to 70 °C and pressures up to 9 bar, and is immune to the presence of water vapor. The occasionally required replacement of the sensor's membrane body is a simple task that can be achieved in a few minutes.

A further benefit of the sensor is that it can be calibrated in air, negating the need for costly calibration gases. Automatic temperature and pressure compensation in the partnering METTLER TOLEDO transmitter provides assurance of accurate measurements on the display at all times.

Secure production environment

Implementing the METTLER TOLEDO solution has resulted in a significant drop in part replacement, maintenance costs, and nitrogen use. More importantly, plant safety and production efficiency have been improved. According to Mr. Weiping Qin, Engineering Department Manager at the facility, "Installation of the METTLER TOLEDO systems means a more secure production environment and lets us focus more on the production process."

If you need to maintain inert conditions at your facility, go to:

► **www.mt.com/o2-gas**

Best Practice

Free guide to process analytics in the chemical industry

Our new eBooklet is full of success stories on how our customers solved their analytical measurement challenges.

Get the guide at:

► **www.mt.com/pro-chem-ebook**

$ 10,000's per Month Saved
in Uranium Leaching

Efficient leaching of uranium from ore requires tight dosing of sulfuric acid via pH measurement. But process conditions mean accurate pH determination is not easy. For a leading producer of uranium oxide, switching to METTLER TOLEDO pH systems has significantly reduced acid consumption.

Major producer of uranium oxide

Energy Resources of Australia Ltd (ERA) is one of the world's largest uranium producers. Uranium has been mined at its Ranger facility for three decades, making it Australia's longest, continually operating uranium mine. Ranger is one of only three mines in the world to have produced in excess of 100,000 tonnes of uranium oxide.

ERA (majority owned by Rio Tinto) sells its product to power utilities in Asia, Europe and North America under strict international and Australian Government safeguards. It sustains long term relationships with its customers by maintaining an excellent track record of reliably supplying uranium oxide.

Challenging measurement application

Producing high quality uranium oxide from ore involves many operations, a primary one of which is leaching, during which finely pulped ore is oxidized by ferric ion and dissolved in a sulfuric acid solution.

Correct acid dosing is vital for maximizing uranium yield and minimizing acid use. However, at the low pH levels required for the process, a large increase in acid dosing results in a relatively small change in pH. Therefore, maintaining pH in the desired range is often achieved at the expense of excessive acid use. To complicate matters the high concentration of abrasive solids and the presence of gypsum in the leaching tanks lead to damage and scaling of equipment, making reliable pH measurement using in-line probes highly problematic.

Robust pH solution

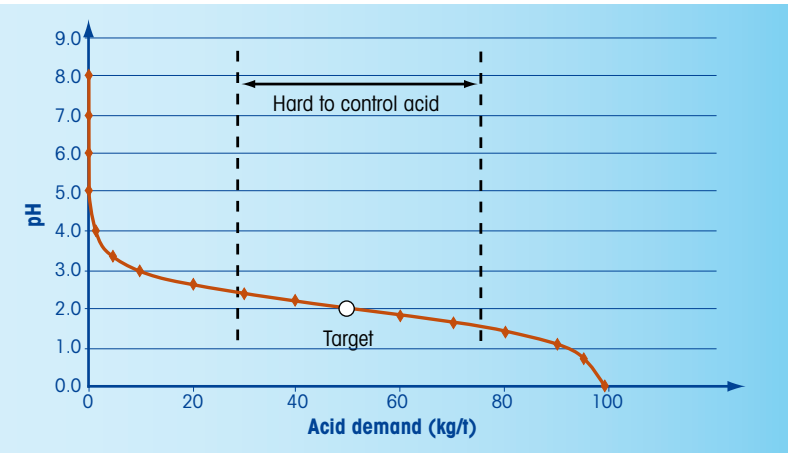
ERA production engineers, unsatisfied with the performance of the system they were using, were looking for a solution that could deliver accurate pH measurements, despite the process conditions, and without requiring high maintenance.

METTLER TOLEDO installed a system based around our InPro 4800 i pH electrode. Its tough glass membrane, strong resistance to oxidizing media and acid solutions, and dirt-repelling PTFE junction make it highly suitable for use in leaching applications. The modular M700 transmitter was selected for use with the electrodes. This multi-channel, multi-parameter unit is equipped with three module slots allowing it to be configured to measure two parameters, plus a choice of communications protocol.

InPro 4800 i
pH electrode

Intelligence brings further benefits

METTLER TOLEDO's Intelligent Sensor Management (ISM) concept brings additional benefits that were very attractive to ERA. ISM sensors use an internal microprocessor to digitize the analog measurement signal before sending it to the transmitter. As the signal is digital it is unaffected by interference caused by surrounding equipment or moisture in the environment and is also reliable over long cable runs.



Acid dosing curve for pH control

In addition, ISM offers predictive diagnostics tools. These indicate when sensor calibration, cleaning or replacement will be required, therefore allowing maintenance to be scheduled for when it is needed rather than conducting, perhaps unnecessary, preventative maintenance.

A further feature of ISM is the ability to calibrate sensors away from the process in a convenient location such as a lab or maintenance room. Using METTLER TOLEDO's iSense Asset Suite software on a PC or laptop and a USB connection InPro 4800 i electrodes can be accurately calibrated then stored until they are required. Thanks to ISM's Plug and Measure feature, when a pre-calibrated InPro 4800 i is connected to its transmitter the system is ready to use in a few moments.

Substantial reduction in acid use

ERA is highly satisfied with the performance of the METTLER TOLEDO solution. Production engineers have found the InPro 4800 i to be extremely reliable, and ISM's diagnostics tools have greatly simplified maintenance scheduling. Most significantly of all, the tight pH control that is now possible has reduced the use of sulfuric acid by $ 10,000's per month.

If you want to reduce costs at your plant, go to:

- **www.mt.com/InPro4800i**
- **www.mt.com/ISM**

Dependable Chemical Dilution
with Conductivity Measurement

Ensuring correct dilution of chemicals is important for process and cost efficiency. Conductivity measurement is a highly accurate determinant of concentration for a wide range of chemicals. Robust inductive conductivity sensors are ideal for this purpose.

Conductivity and concentration

In many processes, chemicals of a certain concentration are used as reagents. To save on transportation costs and storage space these chemicals are usually delivered and stored in high concentrations. Before storage strength chemicals can be used in a plant, they have to be diluted. A process for which a control strategy is needed. Conductivity in a broad number of cases is a function of concentration and can therefore be used to control the makeup system.

Dilution control

First of all, it has to be determined whether conductivity is a function of concentration for the chemical in question. This is usually the case for any acid, alkali or salt. Because it is a very easy and reliable measurement, sometimes marker ions are used with non-conductive chemicals in order to make concentration conductivity dependent. Secondly, the conductivity vs. concentration curve for the particular chemical has to be taken into consideration. Only if the peak is not enclosed in the working range can conductivity be unambiguously related to the concentration.

Tight concentration control means the correct concentration is used in the process. Using valuable chemicals in concentrations that are too high is obviously an expensive waste; whereas, concentrations below the required range will lengthen the process time, or reduce product yield or quality.

Durable and highly sensitive inductive conductivity sensor

The best solution for this application is use of an inductive conductivity sensor. Modern inductive sensors such as the InPro 7250 have the sensitivity to detect very small changes in conductivity, which is necessary for accurate measurement.

The media-wetted parts of the InPro 7250 are coated with perfluoroalkoxy alkane, a material that is highly resistant to organic and inorganic acids including nitric and hydrofluoric. As the surface is immune to contamination and deposit formation, high measurement accuracy and process reliability are always ensured. The large measuring range and concentration determination capability of the InPro 7250 PFA make it uniquely suitable for use in concentration control applications.

Find out more at:
▶ **www.mt.com/InPro7250**

InPro 7250 PFA conductivity sensor

Accurate Drying Results
for High Coating Quality

The coating experts from Schekolin, in Lichtenstein, have used the Halogen Moisture Analyzer from METTLER TOLDEO for many years to maintain the fast and efficient determination of lacquer and paint dry matter. Schekolin has been testing SmartCal™, a new and highly sensitive reference substance from METTLER TOLEDO, to accurately control the performance of their Moisture Analyzers.

Schekolin uses the Halogen Moisture Analyzers HB43-S and HR83 from METTLER TOLEDO to determine the solid content of coatings for the packaging surfaces of cans, tubes and lids. Comparisons with the traditional drying oven technique show that Halogen Moisture Analyzer results are reliable and match those obtained with the reference method. However, as with any other analytical instrument, the performance of the Moisture Analyzer itself needs to be tested at regular intervals. Conventional calibration procedures test the heating module and the balance separately, which is time-consuming but necessary. Omitting this tedious procedure for longer time periods may lead to unpleasant surprises, considers Bodo Schallenburger, head of development for sheet coatings at Schekolin, "Between two calibrations slight instrument drifts may remain undetected."

Verifying instrument performance in just 10 minutes

In order to fill the gap between calibrations, it is recommended that the user regularly checks the instrument with an overall system test. SmartCal is a new reference substance used to verify the entire Moisture Analyzer system in one step. It is as simple to perform as a normal measurement and can be used at typical operating temperatures. In just 10 minutes, the SmartCal test indicates if the Moisture Analyzer is working within control limits. If so, the instrument can be safely used for routine measurements.

This smart quality tool is quick and easy to handle and ensures valid measurements. For Bodo Schallenburger, it is a valuable tool to complement his quality control system, "SmartCal can be easily applied in daily lab practice and adds to the trust basis we work on with our customers."

▸ **www.mt.com/smartcal**

SmartCal – the fast and easy test to verify all METTLER TOLEDO Halogen Moisture Analyzers within 10 minutes.

Are you testing enough – or maybe too much?

The optimal testing frequency for verifying Moisture Analyzers depends on specific process needs and working environments.

Get your free personalized, risk-based testing recommendation at:

▸ **www.mt.com/smartcal**

Oxygen Analysis Made Easy
with Powerful In-line TDL Sensors

When it comes to process safety for protecting the environment, people, and assets, only the best equipment will do. METTLER TOLEDO's new O_2 solution offers the convenience and ease of use of an in-line sensor, and the performance of a powerful gas analyzer. With the GPro™ 500, oxygen measurement is simpler and more reliable than ever before.

METTLER TOLEDO's GPro 500 represents a revolution in oxygen sensors. Packed with state-of-the-art technology it offers exceptional measuring performance and easy installation, and requires little or no maintenance.

Tunable Diode Laser (TDL) gas analyzers are a significant improvement over extractive analysis systems. METTLER TOLEDO has combined TDL technology with our long-standing expertise in industrial application analytical instrument design. The result is a probe that delivers the convenience of an in-line sensor and the level of measurement performance of a top-line analyzer.

Find out more at:
► **www.mt.com/o2-TDL**

Your benefits

No sample extraction or conditioning required
GPro 500 measures in situ and does not require costly and breakdown-prone sampling equipment.

Minimal maintenance
Other than yearly verification and occasional cleaning of the optics, no other maintenance is necessary.

Simple installation
Other TDL sensors are of a cross-stack design that causes installation difficulties. GPro 500 needs only one flange and no alignment.

GPro 500 TDL oxygen sensor

Get in-line with METTLER TOLEDO

Easy Sensor Calibration
with Free Maintenance Software

Intelligent Sensor Management (ISM) is helping to improve productivity in process industry companies the world over.

iSense Asset Suite, the partnering software for ISM sensors, allows easy sensor calibration in a convenient location away from the process, sensor diagnostics for increased process uptime, traceability over a sensor's lifetime, and much more.

A free version of iSense, iSenseLight, has all the main features of the full software. No license is required and there is no need for registration.

With iSenseLight, ISM sensors and transmitter, and an iLink USB cable you immediately get all these benefits:

- Fast and easy sensor calibration in a convenient location
- Predictive maintenance diagnostics
- Configuration of optical oxygen sensors
- Printable calibration reports

▶ **www.mt.com/iSenseLight**

ISM

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www.mt.com/pro
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