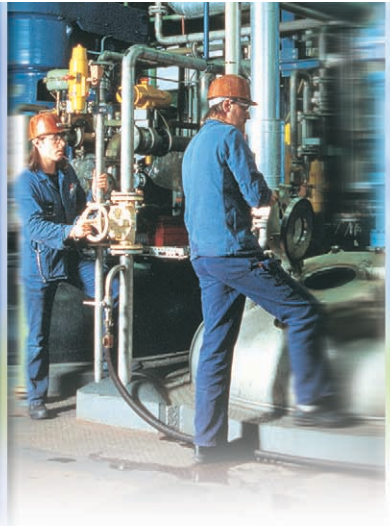
pH Measurement
in Electroplating Processes



Notes

Continuous pH measurements in electroplating process baths improves cost-of-ownership at MTU Munich, Germany.

Process Analytics

Success Story

MTU in Munich, Germany.

It would be hard to imagine present day industrial activity without electroplating or galvanization processes. Galvanizers are partners of the most far-reaching branches of industry, including machinery, electronics, jewelry and furniture manufacturers. As a result, they are suppliers to industrial sectors such as the automobile, aerospace, computer and semiconductor industries as well as to producers of electrical and electronic components.

In the plating industry, product quality and environmental compatibility are given pride of place. An example for this is the existence of the German "Gütegemeinschaft Galvanotechnik e.V." (Association for Quality in Electroplating Technology"). The yard-stick for quality assurance is the sum of the current demands of the market and of the customers, combined with technological advances in electroplating technology and environmental protection measures. For this reason, the scope of analytical requirements demanded from businesses in the plating industry generally have increased substantially during recent years. Over and above regular checking of effluents, analytical procedures relating to the plating baths have taken on increasing importance.

METTLER TOLEDO

Decisive in being able to achieve high-quality end-products are the individual characteristics of the relative process baths. A stable condition in these baths is all-important. Depending upon the actual type of production or on the requirements of ISO 9002, it may be necessary to check the various bath parameters several times a day or even better to carry out overall monitoring on a continuous basis.

These various parameters are for instance, temperature, metal ion concentration, acid/base content or pH value, etc. In some process baths such as those containing chemical nickel, nickel sulfamate, bright nickel, and above all, suspension electrolytes (electrolyte containing solids), the pH value is an important quantity in any monitoring procedure. As the pH value in these baths is subject to continuous change, it is necessary to determine the pH parameter regularly (in suspension electrolyte, daily) and in the event of tolerance deviations, to be able to initiate immediate corrective measures such as the addition of acid or lye.

In the past, pH values were mostly measured offline, that is, a sample was taken from the bath and analyzed in the laboratory. As this procedure is extremely time-consuming, and the measured value is only available with a time lag, there is an increasing tendency to determine the pH value continuously, directly in the bath(s). Continuous measurement of the pH value clearly allows swifter reaction to any change noted, consequently providing improved process safety. At MTU in Munich, a company belonging to Daimler-Chrysler Aerospace, and Germany's leading aircraft engine manufacturer, a comparison test was made between continuous measurements in the above mentioned baths and standard laboratory (grab sample) measurements.

Continuous measurements

Particularly problematic in continuous measurement procedures is the presence of strong electrical fields which could disturb the electronics of the signal amplifier. In addition it has to taken into account that the often quite high solids content of the baths, such as in the case of suspension electrolytes, can very rapidly lead to blockage of the diaphragms of conventional sensors, and consequently to erroneous measurement readings. A measurement system available from METTLER TOLEDO has however proved to be especially suitable for direct measurements in plating baths.

The measuring system for the tests at MTU consisted of the following components: a transmitter pH 2100 e (measuring range 0…14 and output 0/4…20 mA, optional 2-wire with HART®, Profibus®-PA and/or FF available) for data acquisition, a pH electrode HA-405-DXK-S8/120 (pH range 2…14 and temperature range 0…100 °C) fitted in an - InDip 550 housing made of PVC for immersion into the process bath. The electrode has a polymer (XEROLYT®Plus) reference system containing KCl, and two open aperture junctions.

Experimental work

In a first series of trials, the pH value of a nickel sulfamate bath was measured on a continuous basis over a period of several days and the readings compared with parallel laboratory sample measurements. It was shown that the continuous measurement values remained extremely stable and that there were practically no deviations from the measurement values established in the laboratory.

In the second test series, measurements were taken in a bright nickel bath. In this instance, it became clearly apparent that changes in pH value in the bath occurred in relation to the throughput rate of components undergoing plating. The reliability of the continuously measured values were confirmed by parallel laboratory measurements.

In a third series, the pH values in the dispersion coating line were measured. Due to the particularly high content of solid particles (Cr_2O_3), a certain amount of difficulty had been expected. But here also, it was possible to achieve stable and accurate continuous pH readings, with results verified in the laboratory.

Assessment of the measuring point

The measurements taken continuously over a period of eighty days show that the system recommended by METTLER TOLEDO is indeed highly suitable for use in the continuous measurement of pH values in electroplating baths. The electrode delivered stable value in all of the baths included in the test program, and showed no signs of deterioration. It had to be recalibrated once a week. The system is remarkable for its robust features and ease of operation. The cost of installing such a pH measuring loop from METTLER TOLEDO could, in the instance described here, be recouped within the space of

one month, alone through being able to forego sampling and laboratory analysis procedures. Connection to an automatic dosing system for pH correction is also possible, and this would provide still better process safety.

Following the introduction of the InPro 4250 pH electrode (2002), with an integrated temperature sensor and improved performance in the complete pH-range 0…14, this electrode will provide even higher measurement safety and lower maintenance costs. This electrode has an upgraded polymer reference system (XEROLYT® Plus) containing KCl and two open aperture junctions.

pH electrode InPro 4250

A cleaning system, Easy Clean is to recommend as an optimized application solution for efficient and safe measurement procedures in industrial processes. It provides fully automated unattended cleaning and calibrations of pH-measuring electrodes in continuous processes, significantly reducing the maintenance costs. EasyClean is available in a range of models, each designed for satisfy specific application.

Immersion housing InDip 550

Ttransmitter pH 2100 e

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