Application Note AN-PAN-1012

无解液中子和次酸含量的在分析

是一白色金属,具有非常高的硬度、耐腐性和延展性。由于些著特点,金属被广泛用于和表面工程域。化学是一在固体工件表面一合金的自催化化学技。工依于原(次酸)的化学存在,原与金属子生反,从而行。然而,槽化学品的寿命是有限的,因此需要化学品消耗行自控,也是的工控制要求。随着槽使用的延,解液中的反物会量,从而工件的表面和特性生面影。

本工用告介了一定期控化学液中活性成分的方法,以保出均匀的合金。

INTRODUCTION

Electroless nickel plating baths facilitate the chemical reduction of nickel ions to the metal in acidic electrolyte baths. Here, sodium hypophosphite (NaH_2PO_2) is used as the reducing agent; with its help, a very corrosion-resistant nickelphosphorus alloy is deposited on the material surface.

The decisive reaction is the chemical reduction of the nickel and hydrogen ions by the hypophosphite leading to the deposited nickel and hydrogen gas (**Reaction 1**). Little hydrogen gas formation points to a missing or a slow nickel deposition. The quicker this reaction occurs, the lower the amount of phosphorus in the coating. On the other hand, more phosphorus is contained in the coating when the reaction is slowed down. Coatings with high amounts of phosphorus (10–14%) are very resistant to corrosion, whereas higher abrasion resistance is more readily achieved with a low phosphorus content (3–7%).

$$NiSO_4 + NaH_2PO_2 + 3H_2O \rightarrow Ni + 2H_2 + H_2SO_4 + 3NaH_2PO_3$$

$$3NaH_2PO_2 \rightarrow NaH_2PO_3 + 2P + 2NaOH + 3H_2O$$

Reaction 1. Reaction of electroless nickel deposition.

As nickel ions and hypophosphite are continuously consumed during the deposition process, the concentrations of these components must be kept within defined tolerances and continuously replenished to maintain consistent quality in the final product.

When the plating bath is in use, the concentrations of sulfate and sodium phosphite (NaH_2PO_3) steadily increase; this becomes the limiting factor when the bath is in use for a long time. As more nickel is deposited than phosphorus, more sulfuric acid than sodium hydroxide is formed as the process continues. This leads to a decrease in pH during nickel deposition which must be increased again by the addition of sodium hydroxide or ammonia. Only exact and reproducible determination of the process-relevant parameters can ensure that the consumed bath components can be replenished correctly to guarantee optimal process control.

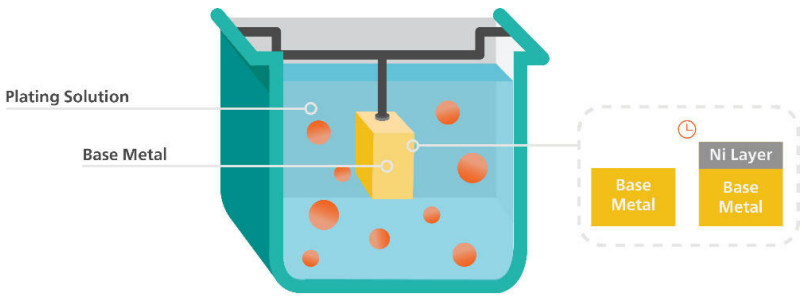

Figure 1. Schematic diagram of the electroless nickel plating process.

APPLICATION

Online monitoring of the pH, nickel, and hypophosphite content is possible with the 2060 Process Analyzer from Metrohm Process Analytics (Figure 2). All liquid handling steps such as taking sample aliquots, dosing of reagents, titration, and cleaning are performed by pumps and burets controlled by the process analyzer.

The analysis consists of transferring a sample aliquot either to the vessel for alkalinity and nickel analysis or to the vessel for sodium hypophosphite determination.

The 2060 Process Analyzer enables simultaneous, monitoring of diverse bath parameters with a single measurement, increasing measurement frequency. Nickel and pH are determined by online titration (Figure 3), and sodium hypophosphite is determined by potentiometric titration using a platinum electrode.

Figure 2. 2060 Process Analyzer

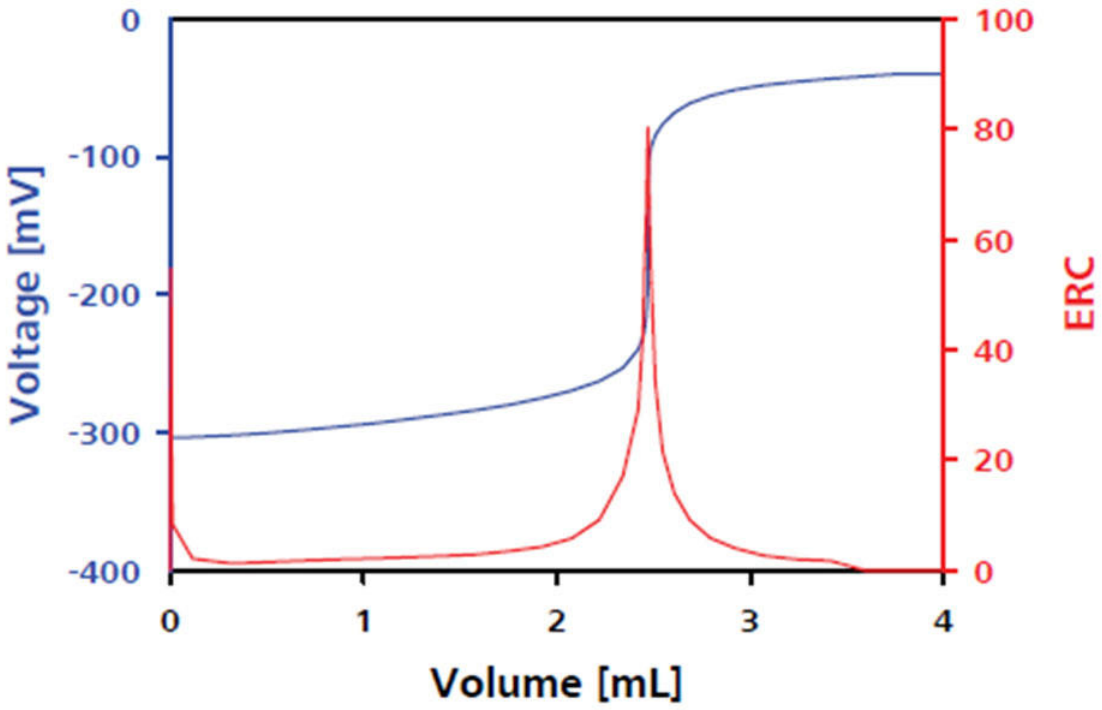

Figure 3. Back-titration curve of iodine using thiosulfate. ERC: Equivalence point Recognition Criterion.

Manual data collection can affect product quality, reduce yield, and expose personnel to hazardous conditions. This robust process analyzer has the flexibility to automatically recognize the titration endpoint to guarantee reproducibility of results, and high reliability and dispense accuracy of the bath constituents. The 2060 Process Analyzer can be programmed to acquire data at regular intervals without needing to wait for laboratory results, and out-of-specification readings can immediately inform operators to take direct action.

Table 1. Parameters to monitor in electroless nickel plating baths

Analyte	Range
Ni as nickel sulfate ($NiSO_4$)	<10 g/L
NaH_2PO_2	1–12 %
pH	4.5–5.0

CONCLUSION

Knowing the exact concentration of the active bath constituents in an electroless nickel plating bath is crucial since early measures can be taken if necessary. This includes the timely replenishment of the consumed components to ensure an even coating deposition and the separation of formed contaminants. Online monitoring of plating baths ensures the quality of the final product, meaning higher yields and less downtime as well as a reduction in operation costs by extending the bath life.

FURTHER READING

Determination of acids, bases, and aluminum: galvanic industry – metal surface treatment

Online and atline analysis of acids and iron in pickling baths

BENEFITS FOR TITRATION IN PROCESS

- **Increased final product quality and metal turnover (MTO)** due to online determination of bath parameters
- **Fully automated diagnostics** – automatic alarms for when samples are out of specification parameters
- **Safer working environment** and automated sampling

CONTACT

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CONFIGURATION

2060 Process Analyzer

2060 Process Analyzer 是一在湿化学分析,用于无数用。此程分析提供了一个新的模化概念,由一个称«主机»的中心平台成。

主机由部分成。上部包含触摸屏和工算机。下部含有柔性取部,其中放有用于分析的硬件。如果主取部容量不足以分析挑,那主机可以展多四个外的取部机,以保有足的空来具挑性的用。附加机的配置方式使每个取部机可以与具有集成(非接触式)液位的合使用,以增加分析的正常行。

2060 Process Analyzer 提供不同的湿化学技:滴定法、舍滴定法、光度定、直接量和准添加入法。

足所有目要求(或足的所有需求),可提供品理系,以保分析解决方案可靠。我可以提供任何品理系,如冷却或加、和脱气、等。