Analysis of electroplating baths

Automatic pipetting with the OMNIS Sample Robot S

Electroplating processes are used in several different industry sectors to protect the surface quality of various products against corrosion or abrasion and significantly improve their working life. Depending on the bath composition, the outcome of this sophisticated process can vary for example in the layer thickness. It is therefore essential to check the bath composition on a regular basis to ensure that the process is operating correctly.

Typical examples of electroplating baths include alkaline degreasing baths or acidic or alkaline baths containing metals e.g. copper, nickel, or chromium, or components like chloride and cyanide. It is crucial that the chosen analysis technique fulfills high safety standards for these kinds of analyses and produces reliable results.

The OMNIS Sample Robot system automatically pipettes and analyzes aggressive electroplating bath samples on different workstations. This reduces operator exposure to the often-harmful samples and increases sample throughput. The use of an OMNIS Sample Robot provides more reliable results in comparison to manual titration and is more time efficient, in particular due to the use of several workstations, where different parameters can be analyzed in parallel.

Find more information in the video:

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SAMPLE AND SAMPLE PREPARATION

In this application note, model substrates which are often found in common electroplating baths were prepared and then analyzed with the described setup: 0.5 mol/L $CuSO_4$ solution in 0.5 mol/L H_2SO_4, 0.5 mol/L $NiCl_2$ solution, and 1.0 mol/L NaOH solution.

EXPERIMENTAL

The entire process is fully automated, including the sample transfer via pipette, the addition of water or auxiliary solutions, the rinsing of the sensor and titration beaker, as well as removing the analyzed sample by the pumps. The only manual action is the filling of the beaker with the sample.

INSTRUMENTATION

The setup consists of two OMNIS Sample Robot S with four Pick&Place modules and two OMNIS pipetting equipments, allowing fast analysis of multiple parameters at the same time. The OMNIS Titrators, Dosing Modules, as well as the 846 Dosing Interface with 800 Dosinos are equipped with various titrants as well as auxiliary solutions, which are all dosed automatically. Small volumes of the sample can be automatically transferred with the pipetting equipment, minimizing any human contact with the hazardous bath constituents.

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Figure 1. OMNIS Sample Robot S with an OMNIS Titrator and three Dosing Modules. Not pictured: additional OMNIS Sample Robot with Titrator and Dosing Modules as well as required Dosing Interface and Dosinos.

Table 1. Summarized results of the mean value (n = 6) of the various electroplating bath samples.

Sample	Content in mol/L	Relative standard deviation
$CuSO_4$ in H_2SO_4	0.4790 H_2SO_4 0.5004 Cu(II)	0.05% 0.26%
$NiCl_2$	0.9985 Cl$^-$ 0.5074 Ni(II)	0.22% 0.28%
NaOH	1.0004	0.17%

RESULTS

Low relative standard deviations for the different sample analyses show excellent reproducibility and demonstrate the outstanding accuracy of the pipetting equipment. A direct comparison between various sample volumes show that even with 0.3 mL of pipetted sample, reliable and accurate results were obtained.

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CONCLUSION

The OMNIS Sample Robot S equipped with the pipetting equipment is a fast, safe, and reliable setup to automate analysis of electroplating baths. Moreover, multiple parameters of a single sample can be easily determined in one run.
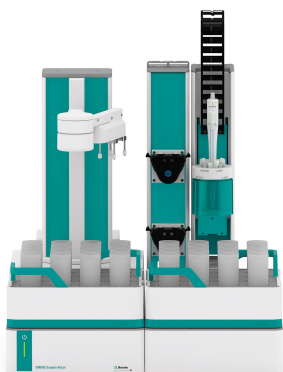
Internal reference: AW TI CH-1320-042021

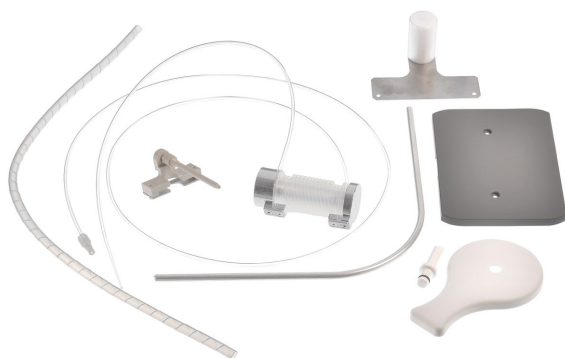## CONTACT

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CONFIGURATION

OMNIS Sample Robot S Pick and Place

OMNIS Sample Robot S 具有一个"蠕"模(2 通道)和一个 Pick&Place 模以及大量附件,可直接入全自滴定。此系具有个品位置,可用于 32 个 120 mL 的品。此模化系供已完全安装完,因此可在短内投入行。
系也可根据需要展配外台蠕以及多加一个 Pick&Place 模,由此使通量翻倍。如果需要更多工作台,可将此 Sample Robot 展 L 格款型的 OMNIS Sample Robot,由此可使七个品的品在多四个 Pick&Place 模上并行理,将品通量大四倍。

OMNIS

完整附件,用于将 OMNIS Sample Robot Pick&Place 改装可行移液的器型号。套件可安装在所有版本 OMNIS Sample Robot(大号、中号和小号)上。

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OMNIS Basic Titrator

新型、模式位分析 OMNIS Titrator 滴定,用于行点定滴定。由于采用 3S 瓶配器技,理化学品从未像在一安全。可以使用量模和量管元自由配置滴定,并在需要展一台拌器。在需要可以通相的件功能可展 OMNIS Basic Titrator 的功能范。

- 通算机或本地网控制
- 可以展磁力拌器和/或螺旋拌器
- 可提供不同大小的量管:5、10、20 或 50 mL
- 可以其他用或助溶液外接最多四个滴定模或加液模
- 采用 3S 技的瓶配器:安全理化学品,自生商的原始数据

量模和件:
- 点定滴定:"Basic" 功能可
- 点和等当点滴定(一/):"Advanced" 功能可
- 点和等当点滴定(一/),包括平行滴定:"Professional" 功能可

OMNIS Dosing Module

用于与 OMNIS Titrator 滴定相的加液模,以展外用于滴定/加液的滴定管。可以展磁力拌器和/或螺旋拌器,以作独的滴定台使用。可自由 5、10、20 或 50 mL 量管元。

846 Dosing Interface

USB 功能的控制元,用于接多至四台 800 Dosino 或 805 Dosimat 行加液和 Liquid Handling 作。需要 Touch Control 或至安装有 OMNIS Software、tiamoTM、MagIC Net, viva 或 797 VA Computrace 的算机行操作。

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800 Dosino

,有可用于智能型加液元的/写硬件。固定。

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