



Application Note AN-T-223

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:

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.



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 ₂ SO ₄	0.4790 H ₂ SO 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.

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.

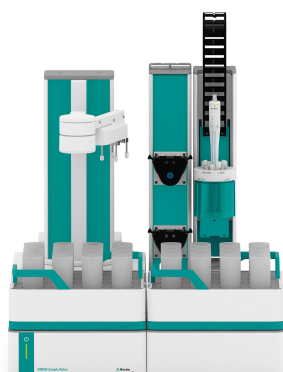
Internal reference: AW TI CH-1320-042021

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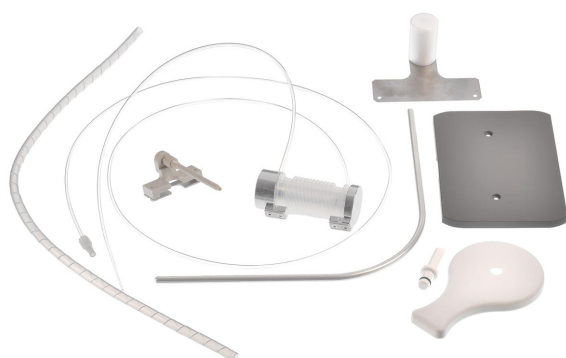
CONFIGURATION



OMNIS Sample Robot S Pick and Place

OMNIS Sample Robot S 具有一个“蠕动”泵模块(2通道)和一个 Pick&Place 模块以及大量附件,可直接进入全自动滴定。此系统具有两个样品盘位置,可用于 32 个 120 mL 的样品盘。此模块化系统供货时已完全安装完毕,因此可在极短时间内投入运行。

该系统也可根据需要扩展配备另外两台蠕动泵以及多加一个 Pick&Place 模块,由此使通量翻倍。如果需要更多工作台,则可将此 Sample Robot 扩展为 L 规格款型的 OMNIS Sample Robot,由此可使七个样品盘的样品在多达四个 Pick&Place 模块上并行处理,将样品通量扩大四倍。



OMNIS

完整附件组,用于将 OMNIS Sample Robot Pick&Place 改装为可进行移液的仪器型号。该套件可安装在所有版本 OMNIS Sample Robot(大号、中号和小号)上。



OMNIS Basic Titrator

创新型、模块式电位分析 OMNIS Titrator 滴定仪,用于进行终点设定滴定。由于采用 3S 试剂瓶适配器技术,处理化学品很安全。可以使用测量模块和计量管单元自由配置滴定仪,并在需要时扩展一台搅拌器。在需要时可以通过相应的软件功能许可证扩展 OMNIS Basic Titrator 的功能范围。

- 通过计算机或本地网络控制
- 可以扩展磁力搅拌器和/或螺旋搅拌器
- 可提供不同大小的计量管:5、10、20 或 50 mL
- 可以为其他应用或辅助溶液另外连接四个滴定模块或加液模块
- 采用 3S 技术的试剂瓶适配器:安全处理化学品,自动传输生产商的原始试剂数据

测量模式和软件选项:

- 终点设定滴定:“Basic” 功能许可证
- 终点和等当点滴定(单一/动态):“Advanced” 功能许可证
- 终点和等当点滴定(单一/动态),包括平行滴定:“Professional” 功能许可证



OMNIS Dosing Module

用于与 OMNIS Titrator 滴定仪相连的加液模块,以扩展额外用于滴定/加液的滴定管。可以扩展磁力搅拌器和/或螺旋搅拌器,以作为单独的滴定台使用。可自由选择 5、10、20 或 50 mL 计量管单元。



846 Dosing Interface

带 USB 功能的控制单元,用于连接多至四台 800 Dosino 或 805 Dosimat 进行加液和 Liquid Handling 作业。需要 Touch Control 或连至安装有 OMNIS Software、tiamo™、MagIC Net, viva 或 797 VA Computrace 的计算机进行操作。



800 Dosino

800 Dosino 驱动头,带有可用于智能型加液单元的读/写硬件设备。带固定电缆。