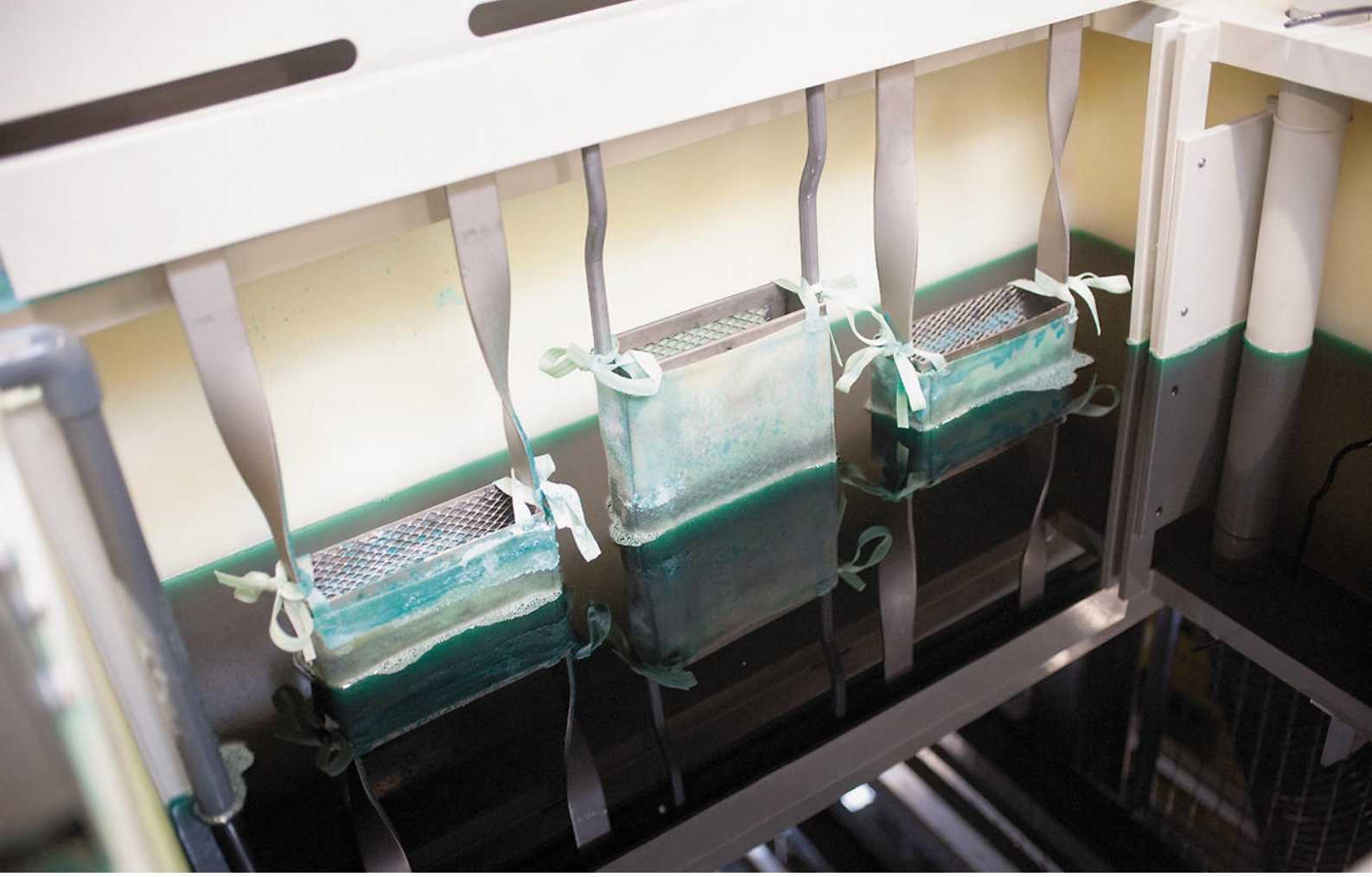

Application Note AN-T-223

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_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.

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.

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