

Application Note AN-V-196

Antimony and bismuth in electroless nickel baths

Stabilizer determination using anodic stripping voltammetry

Lead was commonly used as a stabilizer in electroless nickel plating processes in the past. The regular and precise determination of the stabilizer concentration is essential to keep the plating process running successfully under stable conditions. With the increasing number of restrictions in recent years on the use of lead in consumer products, particularly electronics, alternative stabilizers were developed and introduced. Two of these alternative stabilizers used to replace lead are antimony and bismuth. Electroless nickel plating is used in various industrial

production processes. The ENIG (electroless nickel, immersion gold) and ENEPIG (electroless nickel, electroless palladium, immersion gold) processes in the production of printed circuit boards are very reliant on the success of this method as electroless nickel plating is the first step in the process. Differential pulse anodic stripping voltammetry has been established as a straightforward, sensitive, selective, and interference-free method for this application.

SAMPLE

Electroless nickel plating bath

EXPERIMENTAL

After diluting the sample in supporting electrolyte, the voltammetric determination of antimony and bismuth is carried out on the 884 Professional VA with the Multi-Mode Electrode pro as working electrode using the parameters listed in **Table 1**. The concentration is determined by two additions of antimony and bismuth standard addition solution.



Figure 1. 884 Professional VA.

Table 1. Parameters for the determination of Sb³⁺ and Bi.

Parameter	Setting
Working electrode	HMDE
Mode	DP – Differential Pulse
Deposition potential	-0.4 V
Deposition time	30 s
Start potential	-0.3 V
End potential	+0.05 V
Peak potential Sb(III)	-0.16 V
Peak potential Bi	-0.04 V

ELECTRODES

- Working electrode: Multi-Mode Electrode pro with silanized capillaries
- Reference electrode: Ag/AgCl/KCl (3 mol/L) reference electrode with electrolyte vessel. Bridge electrolyte: KCl (3 mol/L)
- Auxiliary electrode: Platinum rod electrode

RESULTS

The determination of antimony and bismuth in electroless nickel plating baths can be carried out in a simple and straightforward manner. The method is selective and free of interferences. It is suitable for concentrations in the low to mid mg/L range.

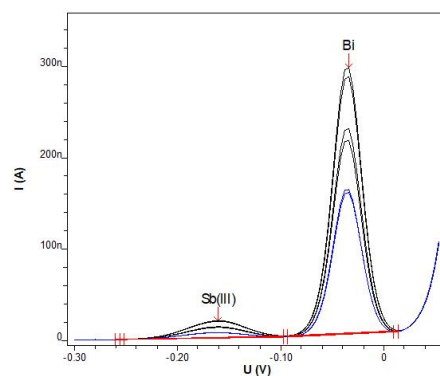


Figure 2. Determination of antimony and bismuth in electroless nickel bath with two standard additions.

Table 2. Results in electroless nickel bath

Analyte	Concentration [mg/L]
Sb(III)	0.4
Bi	4.7

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