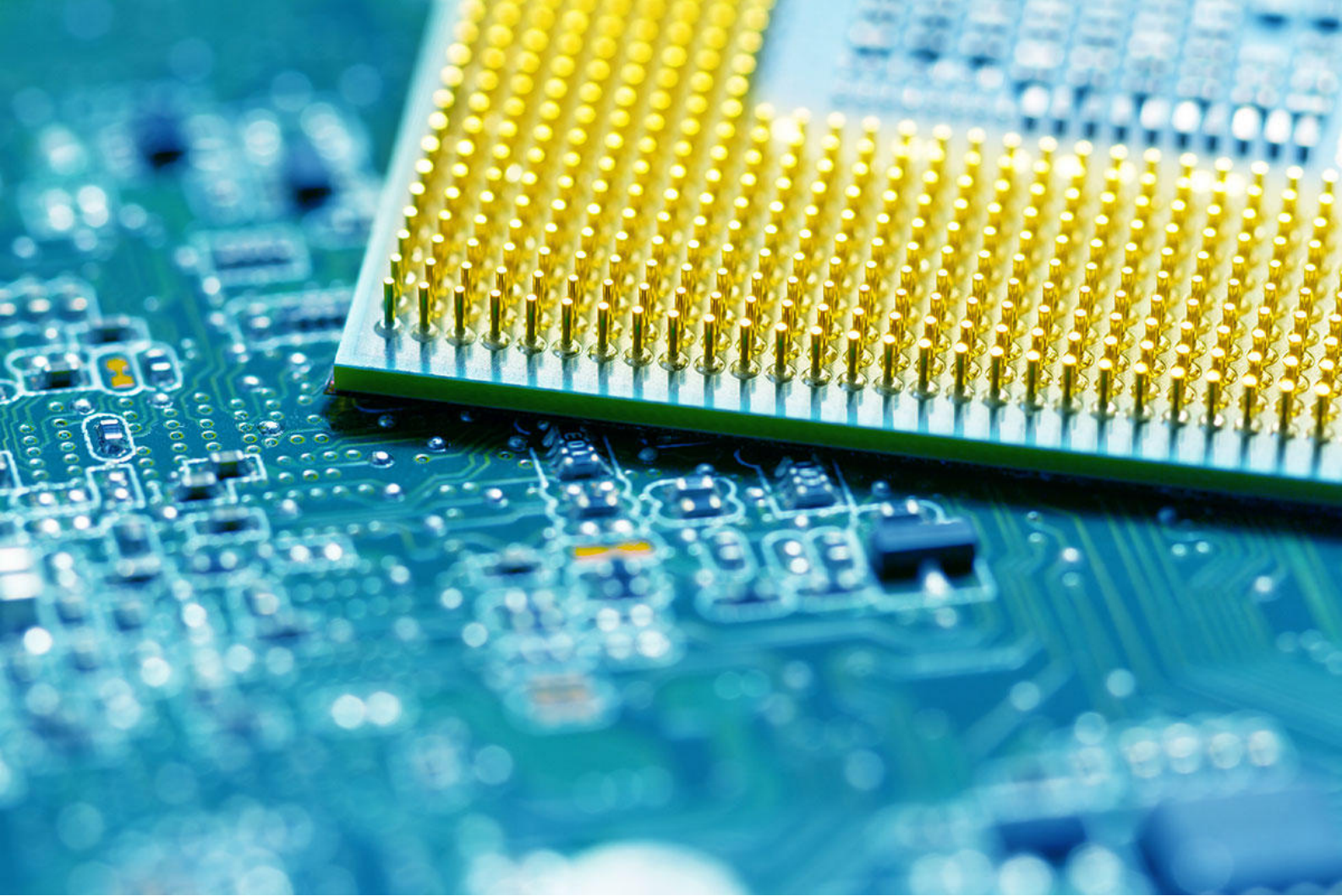




Application Note AN-V-199

Voltammetric determination of gold(I) in gold plating baths

Gold plating bath analysis with the Multi-Mode Electrode pro

In the metal plating industry, particularly during gold electroplating, the meticulous control and determination of gold(I) concentration in the gold plating bath is critical. This not only ensures a high quality and consistent thin layer of gold, but also plays a significant role in optimizing the efficiency and cost of gold plating.

The conversion of Au(I) to pure gold metal is relatively simple and efficient, using one unit of electricity per mole of gold deposited. However, when Au(III) forms and accumulates in the gold bath, it significantly

lowers the current efficiency because the reduction of Au(III) to gold metal requires three units per mole. A lower fraction of Au(I) leads to inefficient use of electricity and gold, making the process more costly and less sustainable.

Voltammetric analysis using the Multi-Mode Electrode pro emerges as a highly effective tool, offering a direct and straightforward method for the determination of gold(I) in both cyanide and sulfite gold plating baths without the need for time-consuming sample preparation.

SAMPLE

Gold cyanide bath Gold sulfite bath

EXPERIMENTAL

Add the electrolyte solution and the gold plating bath sample into the measuring vessel and degas the mixture for five minutes. The determination is carried out using the parameters listed in Table 1. Quantification is done with the 884 Professional VA manual for MME (Figure 1) using two Au(I) standard solutions.



Figure 1. 884 Professional VA manual for MME

Table 1. Parameters

Parameter	Setting
Mode	DME
Start potential	-0.9 V
End potential	-1.75 V
Sweep rate	15 mV/s
Peak potential Au(I)	-1.45 V

ELECTRODES

- Multi-Mode Electrode pro

RESULTS

Figure 2 presents results of Au(I) determination in a gold sulfite plating bath.



Figure 2. Determination of Au(I) in a gold sulfite plating bath, $\beta(\text{Au(I)}) = 12.1 \text{ g/L}$

Table 2. Result

Sample	Au(I) in g/L
Gold cyanide plating bath	1.6
Gold sulfite plating bath	12.1

Internal references: AW CH4-0498-052010, AW CH4-

0412-082004

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CONFIGURATION



884 Professional VA manual for Multi-Mode Electrode (MME)

884 Professional VA manual for Multi-Mode Electrode (MME) is the entry-level instrument for high-end trace analysis with voltammetry and polarography with the Multi-Mode Electrode pro or the scTRACE Gold or the Bismuth drop electrode. The proven Metrohm electrode methods in combination with a high-performance potentiostat/galvanostat and the extremely flexible viva software open up new perspectives for the determination of heavy metals. The potentiostat with a certified calibrator readjusts itself automatically before each measurement, thus guaranteeing maximum precision.

Determinations with rotating disc electrodes can also be performed with the instrument, e.g. determinations of organic additives in electroplating baths with "Cyclic Voltammetric Stripping" (CVS), "Cyclic Pulse Voltammetric Stripping" (CPVS), and chronopotentiometry (CP). The replaceable measuring head enables rapid changes between the various applications with different electrodes.

The **viva** software is required for control, data collection, and evaluation.

The 884 Professional VA manual for MME is supplied with extensive accessories and a measuring head for the Multi-Mode Electrode pro. Electrode set and **viva** license need to be ordered separately.



Multi-Mode Electrode pro

Mercury electrode for voltammetry. Can be operated as DME, SMDE or HMDE.