

<b>HIRANUMA APPLICATION DATA</b>	Automatic Titrator	Data No.	E4	Nov. 28, 2018
<b>PLATING &amp; ETCHING SOLUTION</b>	<b>Quantitative determination of nickel chloride in nickel plating solution</b>			

## 1. Abstract

The control and analysis of nickel plating solution are very important process for the product quality. Analytical components of the general nickel plating solution are 1) nickel sulfate, 2) nickel chloride, and 3) boric acid. This report introduces an example of measurement for nickel chloride in nickel plating solution determined by potentiometric titration with silver nitrate standard solution.



## 2. Configuration of instruments and reagents

### (1) Configuration of instruments

Main unit : Hiranuma Automatic Titrator COM Series  
 Electrode : Silver combination electrode AGR-811Z (Double Junction Type)

\*The following electrodes are also usable.

- AGR-801Z (Silver reference combination electrode)
- Combination of AG-311 (Silver indicator electrode) and MS-231Z (Silver reference electrode)
- Combination of AG-311 and RE-241Z (Double junction type silver reference electrode)

\*Remark

The general reference electrode (RE-201Z) cannot be used for this titration because KCl inner solution might come out to sample solution and it causes measurement error.

The inner electrodes of AGR-801Z and MS-231Z contain mercury (I) sulfate. When these electrodes are disposed, please ask the specialized industrial waste disposal operator.

### (2) Reagents

Titrant : 0.05 mol/L Silver nitrate standard solution

Additive solution : 1 mL of 1 mol/L Nitric acid

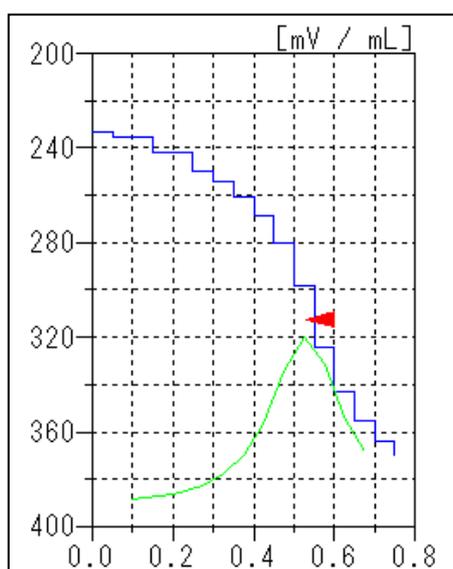
## 3. Measurement procedure

- (1) Dispense 1 mL of sample into a 100 mL beaker with volumetric pipette.
- (2) Add 60 mL of DI water.
- (3) Add 1 mL of 1 mol/L nitric acid.
- (4) Immerse electrode and titrate with 0.05 mol/L silver nitrate standard solution.

## 4. Measurement conditions and results

### Examples of titration conditions

Cnd. No.	1	Constant No.	1	Mode No.	8
Method ^	Auto	Size	1 MI	Pre Int	0 sec
Buret No.	1	Blank	0 mL	Del K	5
Amp No.	3	Morality	0.05 mol/L	Del Sens	0 mV
D.Unit	mV	Factor	0.9941	Int Time	5 sec
S- Timer	5 sec	K	118.84	Int Sens	3 mV
C.P. mL	0 mL	L	0	BrT Speed	2
T.Timer	0 sec	Unit	g/L	Pulse	40
D.P. mL	0 mL	Formula	(D-B)*K*F*M/S		
End Sens	300	Digits	4		
Over mL	0.2 mL	Auto input parameter	None		
Max Vol.	20 mL				



Example of titration curve

### Measurement results

Number of Measurement	Size (mL)	Titrant Volume (mL)	Nickel chloride hexahydrate Concentration (g/L)
1	1	0.528	3.119
2	1	0.528	3.119
3	1	0.527	3.113
Statistic calculation		Avg.	3.12 g/L
		SD	0.0034 g/L
		RSD	0.11 %

## 5. Note

### (1) Quantitative determination method of total nickel

Quantitative determination method of total nickel in nickel plating solution can be performed by the following procedure: add 60 mL of water to 1 mL of sample, add 20 mL of diluted ammonia solution and MX indicator, and then it is determined by photometric titration with 0.1 mol/L EDTA standard solution. (Refer to application data E10.)

### (2) Quantitative determination method of boric acid

Quantitative determination method of boric acid in nickel plating solution can be performed by the following procedure: add 50 mL of water to 1 mL of sample, add 20 mL of 20 % mannitol solution, and then it is determined by potentiometric titration with 0.1 mol/L sodium hydroxide standard solution. (Refer to application data J8.)

Keywords : Nickel plating solution, Nickel chloride, Silver nitrate, Precipitation titration, Boric acid

Some measurement would not be possible depending on optional configuration of system.