

<b>HIRANUMA APPLICATION DATA</b>	Automatic Titrator	Data No.	E11	Apr. 5, 2019
<b>PLATING &amp; ETCHING SOLUTION</b>	<b>Determination of copper in copper sulfate plating solution</b>			

## 1. Abstract

Copper sulfate plating is widely used in plating industries such as ornament, basic plating of anticorrosion plating, and plating for printed circuit board etc. This report introduces an example for determination of copper in copper sulfate plating solution with redox titration as follows: add potassium iodide to acidic sample to oxidize iodide by copper ion and generate free iodine (reaction 1). Titrate this free iodine with sodium thiosulfate to determine copper concentration (reaction 2) by redox titration.



## 2. Configuration of instruments and reagents

### (1) Configuration of instruments

Main unit	: Hiranuma Automatic Titrator	COM series
Electrodes	: Platinum electrode	PT-301
	Reference electrode	RE-201Z

\*The following electrode is also usable instead of the above electrode.

- PR-701BZ (Platinum reference electrode)
- Combination of PT-301 (Platinum electrode ) and GR-501BZ (Glass-reference electrode)

### (2) Reagent

Titrant	: 0.1 mol/L Sodium thiosulfate standard solution
Additive reagent	: Potassium iodide

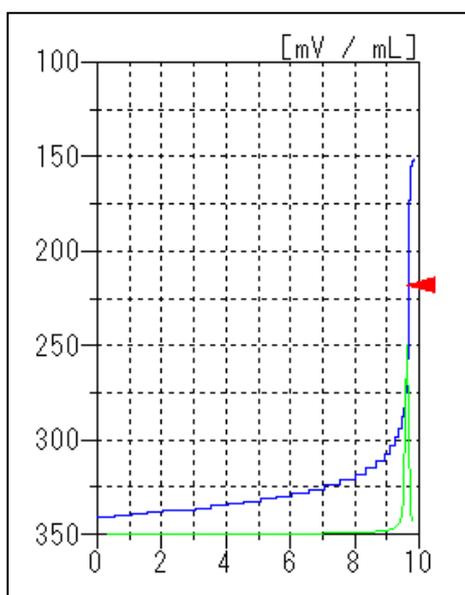
## 3. Measurement procedure

- (1) Dispense 1 mL of sample into a 100 mL beaker with volumetric pipette.
- (2) Add 50 mL of DI water.
- (3) Add about 2 g of potassium iodide.
- (4) Immerse electrodes to start titration with 0.1 mol/L sodium thiosulfate standard solution.

## 4. Measurement conditions and results

### Example of titration condition

Cndt No.	1	ConstantNo.	1	Mode No.	5
Method	Auto	Size	1 mL	Pre Int	0 sec
Buret No.	1	Blank	0.0000 mL	Del K	5
Amp No.	2	Molarity	0.1 mol/L	Del Sens	0 mV
D. Unit	mV	Factor	1.005	Int Time	3 sec
S-Timer	30 sec	K	63.546	Int Sens	3 mV
C.P. mL	0 mL	L	0.000	Brt Speed	2
D.P. mL	0 mL	Unit	g/L	Pulse	40
End Sens	200	Formula	(D-B)*K*F*M/S		0.05 mL
Over mL	0.2 mL	Decimal Places	3		
Max. Vol.	20 mL	Auto In Pram.	None		



Example of titration curve

### Measurement results

Number of Measurement	Size (mL)	Titrant volume (mL)	Copper Concentration (g/L)
1	1	9.623	61.456
2	1	9.622	61.450
3	1	9.632	61.514
		Avg.	<b>61.5 g/L</b>
Statistic calculation		SD	0.0353 g/L
		RSD	0.06 %

## 5. Note

- Successive titration of sulfuric acid and copper

Copper concentration was determined with redox titration in this report. Regarding another analyte in copper sulfate plating solution, there is determination method for sulfuric acid. Sulfuric acid can be determined by neutralization titration with sodium hydroxide standard solution. The addition of one optional buret and two peristaltic pump dispensers allows to successively perform the neutralization titration for sulfuric acid (buret I, included in standard configuration), dispensing sulfuric acid and potassium iodide solution (peristaltic pump dispenser I and II, options), and the redox titration for copper (buret II, option). Glass-reference electrode GR-501BZ and platinum electrode PT-301 are required for this successive titration.

Keywords: Copper sulfate plating solution, Copper, Potassium iodide, Sodium thiosulfate, Redox titration

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