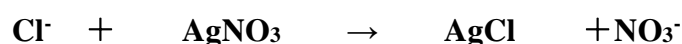


<i>HIRANUMA APPLICATION DATA</i>	Automatic Titrator	Data No.	G2	Apr. 5, 2019
<b>Metals</b>	<b>Determination of trace chloride ion in copper sulfate solution</b>			

## 1. Abstract

This report introduces an example of the determination of trace chloride ion in the solution containing highly concentrated copper sulfate.

The precipitation titration with silver nitrate standard solution is generally used for the determination of chloride ion in copper sulfate solution. The endpoint of the titration is detected with indicator method or the potentiometric method. The potentiometric method is used for this sample because the color change of indicator reagent is obscure in this sample containing highly concentrated copper sulfate. However, it tends to show the difficulty to detect the endpoint because of the less sensitivity of electrode under highly concentrated copper sulfate. Therefore the potentiometric titration is performed with the specially treated silver electrode that the silver chloride is coated.



## 2. Configuration of instruments and reagents

### (1) Configuration of instruments

Main unit	: Hiranuma Automatic Titrator	COM Series
Electrode	: Silver electrode	AG-311A (Silver chloride-coated electrode)
Reference electrode	MS-231Z	

\*The following electrodes are also usable.

- AGR-801AZ (Silver chloride-coated silver reference combination electrode)
- AGR-811AZ (Silver chloride-coated silver reference combination electrode, double junction type)

\*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 use mercury (I) sulfate. When these electrodes are disposed, please ask the specialized industrial waste disposal operator.

### (2) Reagents

Titrant	: 0.01 mol/L Silver nitrate standard solution
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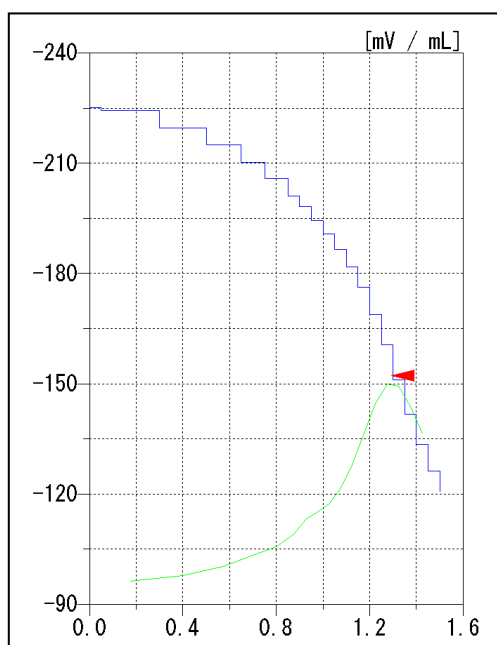
## 3. Measurement procedure

- (1) Dispense 20 mL of sample into a 100 mL beaker with volumetric pipette.
- (2) Add about 20 mL of DI water.
- (3) Immerse electrodes and titrate with 0.01 mol/L Silver nitrate standard solution.

## 4. Measurement conditions and results

### Example of titration condition

Cnd. No.	1	Constant No.	1	Mode No.	8
Method ^	Auto	Size	20 mL	Pre Int	0 sec
Buret No.	1	Blank	0 mL	Del K	5
Amp No.	2	Morality	0.01 mol/L	Del Sens	0 mV
D.Unit	mV	Factor	1.005	Int Time	5 sec
S- Timer	5 sec	K	35.45	Int Sens	3 mV
C.P. mL	0 mL	L	0	Brt Speed	2
T.Timer	0 sec	Unit	PPM	Pulse	40
D.P. mL	0 mL	Formula	(D-B)*K*F*M*1000/S		
End Sens	80	Decimal Places	4		
Over mL	0.5 mL	Auto input parameter	None		
Max Vol.	20 mL				



Example of titration curve

### Measurement results

Number of Measurement	Size (mL)	Titrant Volume (mL)	Chloride ion Concentration (ppm)
1	20	1.294	23.0508
2	20	1.294	23.0508
3	20	1.290	22.9796
Statistic calculation	Avg.		23.03 ppm
	SD		0.04 ppm
	RSD		0.18 %

## 5. Note

### • Indicator electrode

The sensitivity of the electrode is important for this measurement. It tends to show the difficulty on the automatic endpoint detection because of the less sensitivity of normal electrode under highly concentrated copper sulfate. The silver chloride-coated silver electrode can provide acceptable results on this measurement. However, it is degraded by prolonged use even if the silver chloride is coated on the electrode. The recoating of silver chloride is required when the sensitivity of electrode gets lowered.

Keywords: Chloride ion, Precipitation titration, Copper sulfate solution, Copper sulfate plating solution, Silver chloride coating

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