



With respect to the number of ions of both hydrogen and hydroxide when neutralization is complete, both ions are found to be equal in number.

The reaction of acid and alkali is called neutralization reaction, and the method for unknown concentration by using neutralization to determine acid or alkali number is called neutralization titration.

#### 4. Advantage to use Automatic Potentiometric Titrator

The conventional manually operated titration used to determine the endpoint (equivalent point) by watching the change of color of titration liquid using the indicator. The problem with such method was the difficulty in determination when colored titration liquid turned out precipitated or when an appropriate indicator was found unavailable. Also human error was inevitable due to the different methods or techniques used by operators.

In order to solve the above-mentioned problems, the Automatic Potentiometric Titrator was the answer.

#### 5. Kyoto Electronics Mfg. Co., Ltd. lineup of Automatic Potentiometric Titrators and options

	AT-610	AT-510	AT-500N
			
Detection range	1) Potentiometric: -2000mV - + 2000mV 2) pH : 0.00-14.00 pH Temperature : 0-100 degree		
Steps	20,000 steps (for a full stroke)		
Features	High class model with touch-screen	Middle class model with touch-screen	Low Model with touch-screen

# Determination of silver in silver jewellery alloys

Determination of silver concentration of jewellery alloys by Automatic Potentiometric Titrator according to ISO/JIS is a common method which is done on the site for certification of purity and acceptance inspection when buying and selling.

## International Standards

**ISO 11427, ISO13756, JIS H6311**

## Chemical Reaction Formula



## Models



## Calculation Formula

It is required to establish the following two methods according to JIS H6311.

(A) For standardization of titrant  
(Sodium chloride standard solution)

It is important that to get accuracy & repeatability are required to determine correct standardization value of sodium chloride solution (titrant). This standardization is necessary before doing sample determination.

$$C1(\text{mg}) = G1(\text{mg}) / V1(\text{mL})$$

C1: mg of silver amount to react with 1mL sodium chloride standard solution. C1 should be about **10.786 mg**.

G1: Size(mg) of silver

V1: Consumption volume of sodium chloride standard solution(Titrant)

(B) For determination of silver

To determine purity of silver is done with precipitation titration reaction between sodium chloride solution and after standardization.

$$\text{Ag}(\%) = \text{EP}(\text{mL}) * C1 * K1(0.1) / \text{Size}(\text{g})$$

EP(mL): Consumption volume of end point

C1: mg of silver amount to react with 1mL sodium chloride standard solution(titrant)

Size(g): sample size

K1:100(%) / 1000(mg/g) = 0.1

## Electrodes

**98100C373 Combined silver electrode**

(Inner solution KNO<sub>3</sub>)

(Alternative 98100M241, 98100R272, cable)

## Chemicals

### For standardization

Silver standard (powder)

Nitric acid(1+1)

Pure Water

Sodium chloride Standard (powder)

### For determination of silver

Nitric acid(1+1)

Pure Water

0.1 mol/L Sodium chloride solution

(standardization)

## Remarks

- Sampling on balance should be done with accuracy.
- The concentration of a titrant or the factor will change not only with time but also when making it up or replacing it with a fresh one. In addition, since a factor will affect the measurement results by titration, it should be routinely measured. A factor can be determine with a standard substance after purging a titrant in a titrator.

## Consumption volume of titrant & Sample Size

### For determination of silver (Recommended)

#### With 0.1 mol/L Sodium chloride solution(titrant)

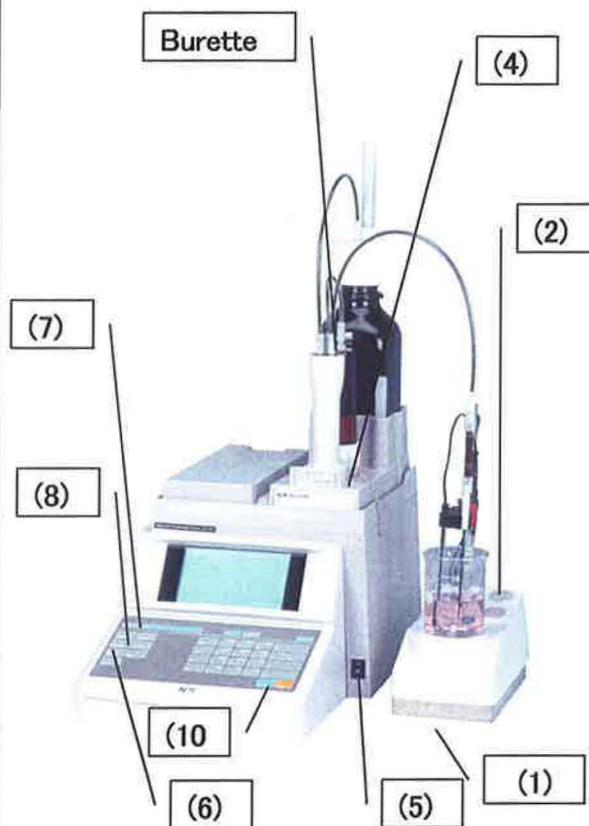
Silver sample(%)	100%	50%	10%
Sample Size(g)	0.15	0.3	1.5
Consumption(mL)	15	15	15

#### With 0.01 mol/L Sodium chloride solution(titrant)

Silver sample(%)	100%	50%	10%
Sample Size(g)	0.015	0.03	0.15
Consumption(mL)	15	15	15

### Quick Start Procedure AT-510

- (1) Assemble the Magnetic stirrer Unit
- (2) Silver Electrode-Connect to the point G1 on back side of stirring unit in case of 98100C373.
- (3) Connect with printer (if necessary)
- (4) Installation of Burette Unit: (Don't FORGET to insert the lock pin in the appropriate socket otherwise you cannot start a test.)
- (5) Switch on the machine
- (6) Copy method and setting up parameters (below parameters) (Please refer to P48 of operation manual. [Function][0.Method][Copy]) Ex) method 11 for standardization, Method 12 for silver determination
- (7) Before starting the test the burette should be air free and filled with titrant. This can be done by purging the titrant several times to out side until the burette unit is air free
- (8) Select Method – Press Method Key and ENTER KEY
- (9) If inner solution in reference electrode falls off lower, add inner solution.
- (10) Press start button to start the test after checking mV stable. Result will be obtained from the printer unit after the test.



#### For standardization

**Method No: 11**

<p>&lt; Auto Intermit &gt;                  &lt;Titration&gt;                  Form: EP stop                  APB No: 1                  Unit No. 1                  Detector No: 1                  Unit: mV                  Max Volume: 30.00mL                  Wait Time: 30 s                  Direction: Auto</p> <p>&lt;Control&gt;                  End Points No. 1                  End Sense: Auto                  End Point Area: Off                  Separation: Off                  Over Titr. Vol: 0.0mL                  Gain : 1                  Data Samp. Pot : 4.0mV                  Data Samp. Vol: 0.1mL</p>	<p>&lt;Calculation&gt;                  Calc. Type : Sample                  Conc.1 : set                  CO1=Size/EP1</p> <p>Unit : mg                  EP No. : 1                  Conc.2 : Off                  Conc.3 : Off                  Conc.4 : Off                  Conc.5 : Off                  Temp. Comp : Off</p> <p>&lt;Constant&gt;</p>
--	--

#### For determination of silver concentration

**Method No: 12**

<p>&lt;Auto Intermit&gt;                  &lt;Titration&gt;                  Form: EP stop                  APB No: 1                  Unit No. 1                  Detector No: 1                  Unit: mV                  Max Volume: 30.00mL                  Wait Time: 15 s                  Direction: Auto</p> <p>&lt;Control&gt;                  End Points No. 1                  End Sense: Auto                  End Point Area: Off                  Separation: Off                  Over Titr. Vol: 0.0mL                  Gain : 1                  Data Samp. Pot : 4.0mV                  Data Samp. Vol: 0.1mL</p>	<p>&lt;Calculation&gt;                  Calc. Type : Sample                  Conc.1 : set                  CO1=EP1*C1*K1/Size</p> <p>Unit : %                  EP No. : 1                  Conc.2 : Off                  Conc.3 : Off                  Conc.4 : Off                  Conc.5 : Off                  Temp. Comp : Off</p> <p>&lt;Constant&gt;                  C1: results from                  Method11                  K1:0.1</p>
--	---