AQUACOUNTER Application Sheet	COM series	DATA No. J7	1st edition
Inorganic Acid	Fractionation quantification of mixture of 3 components; nitric acid, hydrofluoric acid and acetic acid		

1. Measurement outline

The mixture solution of nitric acid (strong acid), hydrofluoric acid (strong acid) and acetic acid (organic acid) is used as acid washing solution or surface treatment solution in electronic semiconductor industry.

This section introduces an example of successive quantification of the mixture solution of 3 acid components by non-aquatic titration with sodium hydroxide in acetone solvent.

$HNO_3 + NaOH \rightarrow NaNO_3 + H_2O$ ---------- (1)

$HF + NaOH \rightarrow NaF + H_2O$ ---------- (2)

$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$ ---------- (3)

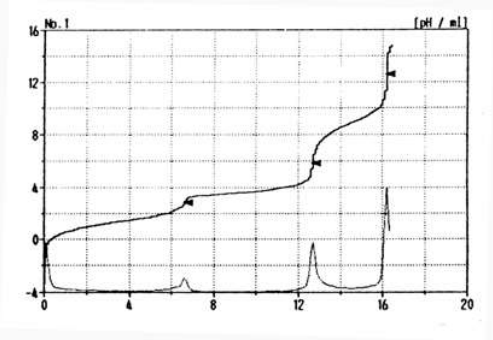
2. Reagents and Electrodes

(1) Reagents	Titrant	1mol/L sodium hydroxide titrant (ethyl alcohol solution)
(2) Electrodes *standard accessories	Indicator electrode	*Glass electrode GE-101B to IE jack
	Reference electrode	*Reference electrode RE-201 to RE jack

3. Measurement conditions example (for COM-1600S)

(1) Method	Auto	
(2) End Sens	200 (nitric acid)	500 (hydrofluoric acid, acetic acid)
(3) Mode	5	
Pre Int	0	
Del K	5	
Del Sens	0	
Int Time	3	
Int Sens	3	
Brt Speed	2	
Pulse	40	

4. Measurement example



Measurement results on nitric acid

Sample No.	Sample volume (g)	Titration value (mL)	Concentration (%)
1	2.54	6.560	40.684
2	2.54	6.566	40.721
3	2.54	6.564	40.708
	Avg.		40.704 %
	Std. Dev.		0.019 %
	C.V.		0.047 %

Measurement results on hydrofluoric acid

Sample No.	Sample volume (g)	Titration value (mL)	Concentration (%)
1	2.54	6.079	11.973
2	2.54	6.091	11.996
3	2.54	6.100	12.014
	Avg.		11.994 %
	Std. Dev.		0.021 %
	C.V.		0.17 %

Measurement results on acetic acid

Sample No.	Sample volume (g)	Titration value (mL)	Concentration (%)
1	2.54	3.504	20.710
2	2.54	3.495	20.657
3	2.54	3.489	20.622
	Avg.		20.663 %
	Std. Dev.		0.044 %
	C.V.		0.21 %

5. Outline

(1) Preparation of sample solution

Approximately 2mL sample was collected in a volumetric flask and was weighed precisely. Acetone was added to the calibration line to be adjusted to 100mL. 2mL of this sample solution was collected and added to 45mL acetone to be titrated.

(2) About successive titration of mixture of 3 components

In this measurement, successive quantification of each component was possible by aqueous solution for this measurement. In titration using aqueous solution, the titration curve indicates 2 inflection points, one indicating the total quantity of nitric acid and hydrofluoric acid and the other indicating the inflection point for acetic acid alone.

(3) Successive titration of mixture of 2 acid components

Applying the non-aqueous titration with acetone solvent in this method, it is possible to successively titrate each component in (1) nitric acid + hydrofluoric acid, (2) hydrofluoric acid + acetic acid, and (3) nitric acid + acetic acid.

Key words

Nitric acid, fractionation titration of hydrofluoric acid and acetic acid, non-aqueous titration, neutralization titration, acetone solvent

Hitachi High-Technologies Corporation
Head Office 1-24-14, Nishishinbashi,Minato-Ku,Tokyo 105-8717, Japan
Tel : 81-3-3504-7239 Fax : 81-3-3835-7302
http://www.hitachi-hitech.com

Hiranuma Sangyo Co.,Ltd.
1739, Motoyoshidacho, Mito-City, Ibaraki 310-0836, Japan
Tel : 81-29-247-6411 Fax : 81-29-247-6942
http://www.hiranuma.com