Application Note AN-T-234

# Direct comparison of OMNIS and Titrando for mixed acids and TMAH

## Comparative titration with OMNIS Titrator and 888 Titrando

Ever since its introduction, the OMNIS platform has been compared to other high-quality Metrohm devices and software. Understandably, OMNIS has had to demonstrate its superior performance over these established systems. One satisfied customer from Taiwan did exactly that and found that the results obtained with OMNIS are even more accurate than with the well-proven Titrando system.

The OMNIS buret with a 100,000 step resolution is superior to the Titrando, with a resolution of either 20,000 steps (Exchange unit) or 10,000 steps (Dosing unit). Furthermore, improved performance of the dTrodes with faster signal transfer and reduced signal noise ensures better results than when using analog electrodes.

This Application Note highlights customer-provided results of determinations of nitric acid, phosphoric acid, and acetic acid in an aluminum etching bath, as well as the determination of tetramethylammonium hydroxide (TMAH). Comparisons were made by using an OMNIS Titrator and an 888 Titrando with identical analysis parameters.

## SAMPLES AND SAMPLE PREPARATION

This application is demonstrated on aluminum etching bath and tetramethylammonium hydroxide (TMAH) samples. The sample preparation is subject to a confidentiality agreement with the customer.

## EXPERIMENTAL

The determinations are carried out on an OMNIS Professional Titrator equipped with a dEcotrode Plus (Figure 1) and an 888 Titrando equipped with an Ecotrode Plus. All selected parameters were identical. The precise determination, the exact parameters, the chemicals used, and the titrant are subject to customer confidentiality.

**Figure 1.** OMNIS Professional Titrator equipped with a dEcotrode Plus.

## RESULTS

A summary of results for the comparison of OMNIS and Titrando for aluminum etching bath samples is shown in Table 1. The full results for each set of determinations are displayed in Tables 2–4.

**Table 1.** Overview of the results of nitric, phosphoric, and acetic acid determination in aluminum etching bath samples with an OMNIS Titrator and an 888 Titrando.

| Device | $HNO_3$ (%) | $H_3PO_4$ (%) | HAc (%) |
|---|---|---|---|
| OMNIS | 4.89 | 70.16 | 9.78 |
| SD(rel) | 0.37 | 0.06 | 0.70 |
| Titrando | 4.97 | 70.07 | 9.73 |
| SD(rel) | 0.28 | 0.14 | 1.56 |

**Table 2.** Results of nitric, phosphoric, and acetic acid determination in aluminum etching bath samples on different days with an 888 Titrando.

| Day | $HNO_3$ (%) | $H_3PO_4$ (%) | HAc (%) |
|---|---|---|---|
| 1 | 4.96 | 69.99 | 9.86 |
| | 4.97 | 69.94 | 9.99 |
| 2 | 4.96 | 70.15 | 9.69 |
| | 4.96 | 70.14 | 9.67 |
| 3 | 4.97 | 70.14 | 9.66 |
| | 4.98 | 70.21 | 9.52 |
| 4 | 4.97 | 70.10 | 9.64 |
| | 4.95 | 69.99 | 9.80 |
| 5 | 5.00 | 70.13 | 9.59 |
| | 4.97 | 69.92 | 9.92 |
| Mean | 4.97 | 70.07 | 9.73 |
| SD(abs) | 0.01 | 0.10 | 0.15 |
| SD(rel) | 0.28 | 0.14 | 1.56 |

**Table 3.** Results of nitric, phosphoric, and acetic acid determination in aluminum etching bath samples on different days with an OMNIS Titrator.

| Day | $HNO_3$ (%) | $H_3PO_4$ (%) | HAc (%) |
|---|---|---|---|
| 1 | 4.87 | 70.13 | 9.87 |
| | 4.87 | 70.12 | 9.84 |
| 2 | 4.88 | 70.16 | 9.73 |
| | 4.87 | 70.17 | 9.77 |
| 3 | 4.89 | 70.26 | 9.70 |
| | 4.91 | 70.14 | 9.78 |
| 4 | 4.90 | 70.16 | 9.69 |
| | 4.90 | 70.14 | 9.78 |
| 5 | 4.92 | 70.13 | 9.72 |
| | 4.90 | 70.18 | 9.88 |
| Mean | 4.89 | 70.16 | 9.78 |
| SD(abs) | 0.02 | 0.04 | 0.07 |
| SD(rel) | 0.37 | 0.06 | 0.70 |

**Table 4.** Results of tetramethylammonium hydroxide (TMAH) determination in β(TMAH) = 2.380% samples on different days with an 888 Titrando and an OMNIS Titrator.

| | 888 Titrando | OMNIS Titrator |
|---|---|---|
| Day | Result (%) | Result (%) |
| 1 | 2.3820 | 2.3788 |
| | 2.3814 | 2.3794 |
| | 2.3813 | 2.3786 |
| 2 | 2.3818 | 2.3785 |
| | 2.3810 | 2.3780 |
| | 2.3816 | 2.3781 |
| 3 | 2.3792 | 2.3776 |
| | 2.3799 | 2.3779 |
| | 2.3803 | 2.3780 |
| Mean | 2.3809 | 2.3783 |
| SD(abs) | 0.0009 | 0.0006 |
| SD(rel) | 0.040 | 0.023 |

## CONCLUSION

In addition to manufacturing high-quality analytical instruments, customer satisfaction is extremely important to Metrohm. The data collected and shared in this Application Note from a satisfied customer in Taiwan clearly shows the outstanding performance of Metrohm titrators.

Aside from improving the precision and speed of the determinations, OMNIS delivers results on par or even better than with other established titration systems.

## CONTACT

Metrohm Nordic Oy
Jaakonkatu 2
01620 Vantaa
mail@metrohm.fi

## CONFIGURATION

OMNIS Professional Titrator with magnetic stirrer

Innovative, modular potentiometric OMNIS Titrator for stand-alone operation or as the core of an OMNIS titration system for endpoint titration and equivalence point titration (monotonic/dynamic). Thanks to 3S Liquid Adapter technology, handling chemicals is more secure than ever before. The titrator can be freely configured with measuring modules and cylinder units and can have a rod stirrer added as needed. Including "Professional" function license for parallel titration with additional titration or dosing modules.

- Actuation via PC or local network
- Connection option for up to four additional titration or dosing modules for additional applications or auxiliary solutions
- Connection option for one rod stirrer
- Various cylinder sizes available: 5, 10, 20 or 50 mL
- Liquid Adapter with 3S technology: Safe handling of chemicals, automatic transfer of the original reagent data from the manufacturer

Measuring modes and software options:

- Endpoint titration: "Basic" function license
- Endpoint and equivalence point titration (monotonic/dynamic): "Advanced" function license
- Endpoint and equivalence point titration (monotonic/dynamic) with 5-way parallel titration: "Professional" function license