ANALYTICAL INSIGHT
SPRING 2009

BALAZS™ ANALYTICAL SERVICES

Upcoming Events

SEMATECH
Surface Preparation and Cleaning Conference
Austin, TX
Mar 23-25, 2009

ESTECH
Schumburg, IL
May 4-7, 2009

NIST
Frontiers of Characterization and Metrology for Nanoelectronics
Albany, NY
May 11-15, 2009

Optima Seminars

Expand your knowledge in engineering and manufacturing solutions to identify, reduce and control contamination. (More information here)

Fremont, CA
Mar 26, 2009

Peabody, MA
Apr 2, 2009

Upcoming dates in Minnesota and Arizona

Designed for all levels of scientists, engineers, and technicians.

To register, please provide your name, title, company name, company email address and seminar you want to attend (date or place) and send to info@balazs.com

www.balazs.com

Analysis of High-Precision TMAH Developer Solutions

In meeting today's integrated circuit design specifications, resist development is a critical process that must be controlled to minimize critical dimension variation. Tetramethyl ammonium hydroxide (TMAH) is a long-used developer in this process, and tight control over TMAH developer specifications has been in use for many years. Current specifications for TMAH are in the 0.2 to 0.3 Normal concentrations (~2.2 to 2.4 % (w/w)), with the variability approaching +/- 0.0005 N. As specifications and required precision are always becoming more stringent in the semiconductor industry, Balazs has developed best-in-class chemical titrations to assure customers that their TMAH developer is in specification and in control for developer concentration…

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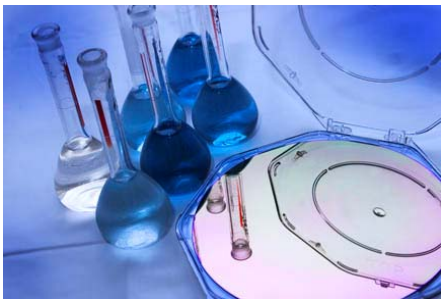
Full 3 Dimensional Characterization for Thin Films



Balazs Analytical Services has performed thin film analyses since its inception, beginning with boron and phosphorus silicate glasses and extending these analyses into the most recent photovoltaic (PV) thin films. Because the analyses are accurate and consistent, and with turn-around times approaching 4 hours for most samples, the results obtained via Balazs thin film analysis have been recognized as industrial standards and used to ensure process consistency and calibrate other techniques…

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Testing for TMAH in Water

TMAH is an organic amine used by the semiconductor industry in a wide number of applications, including photolithography development, wafer cleaning, silica etching, and in CMP slurries. TMAH is widely used because it provides a basic pH solution with no mobile ions, such as Na^+ or K^+. TMAH is also available in high purity semiconductor grade, with low metallic and anionic contamination. As such, TMAH can wind up in water post process, causing potential areas of concern in reclaim, reuse, wastewater, and groundwater. Balazs has developed analytical methodology that allows for testing TMAH in different grades of water from ppt to ppm concentrations…

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AIR LIQUIDE ELECTRONICS

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In meeting today's integrated circuit design specifications, resist development is a critical process that must be controlled to minimize critical dimension variation. Tetramethyl ammonium hydroxide (TMAH) is a long-used developer in this process, and tight control over TMAH developer specifications has been in use for many years. Current specifications for TMAH are in the 0.2 to 0.3 Normal concentrations (~2.2 to 2.4 % (w/w)), with the variability approaching +/- 0.0005 N. As specifications and required precision are always becoming more stringent in the semiconductor industry, Balazs has developed best-in-class chemical titrations to assure customers that their TMAH developer is in specification and in control for developer concentration.

Although we start with a simple acid-base titration, the analysis of these developer solutions with "ultra-tight" specifications is not straight-forward. First to consider is the choice of a standard with minimal uncertainty in its concentration. No NIST-traceable TMAH solution exists as a standard reference material for comparison, and hence **a proper choice for primary and/or secondary standardization is commonly required**. In addition, conventional acid-base analyses with manual burets will have an uncertainty of at least 0.01 mL. Such uncertainty in titrant volume can push the uncertainty in the measurement to +/- 0.0005 N, i.e. at times the width of the entire specification. Automated titrators, far more often the norm for this type of analysis, also have uncertainty, and combined with the uncertainty imparted from different steps in the analysis scheme must be understood to ensure analysis results can be properly judged versus the manufacturing process as well as the customer specification.

Second, semiconductor companies along with simple Gaussian statistics and common sense require measurement precision to be much tighter than an actual chemical specification. This allows the analysis imprecision to not over-whelm variability in the actual chemical product. Moreover, adequate measurement capability allows proper analytical granularity to observe minute changes in TMAH concentration that could fall out of a control specification and affect the process.

Although uncertainty will always be present in every analysis, Balazs scientists understand their sources and have incorporated techniques with proper sampling, sample handing, and **standards used for analysis** to ensure analysis and measurement process capability is appropriate for the tightest TMAH specifications. If absolute developer concentration or developer concentration drift is in question at a fab, Balazs has the metrology in place to provide both accurate and precise results**.**

For additional information, please contact us.

Full 3 Dimensional Characterization for Semiconductor and PV Thin Films

Balazs Analytical Services has performed **thin film analyses** since its inception, beginning with boron and phosphorus silicate glasses and extending these analyses into the most recent photovoltaic (PV) thin films. Because the analyses are accurate and consistent, and with **turn-around times approaching 4 hours for most samples**, the results obtained via Balazs thin film analysis have been recognized as industrial standards and used to ensure process consistency and calibrate other techniques.

With an expansion beyond silicate glass, Balazs analyses a wide range of films that includes CdTe, CIS, CIGS, CG, CdS, Cu_2S, NiCr, SiGe, TiW, AlCu, GST, PZT, to name just a few. Measurement technologies include not only **traditional wet chemistry methods**, but extend to many **advanced technologies** including ICP-OES, ICP-MS, laser ablation ICP-MS, glow discharge emission spectroscopy (GD-OES), SEM-EDX, Auger, ESCA, SIMS and XRD. These instruments enable a **full characterization** of semiconductor and PV thin films in **three dimensions** in order to support the most advanced R&D and manufacturing processes in both semiconductor and PV industries.

Examples of the analyses and expertise Balazs provides for thin film analyses include the following:

- Compositional analysis of semiconductor and PV thin films for major elements
- Analysis of thin films for contamination in the film
- Surface analysis of impurities
- Vertical elemental distribution study (depth profiling)
- Lateral elemental distribution studied (line scan)
- Phase identification of solar cell thin films
- Microscopic or local analysis
- Identification of various defects in and on thin films

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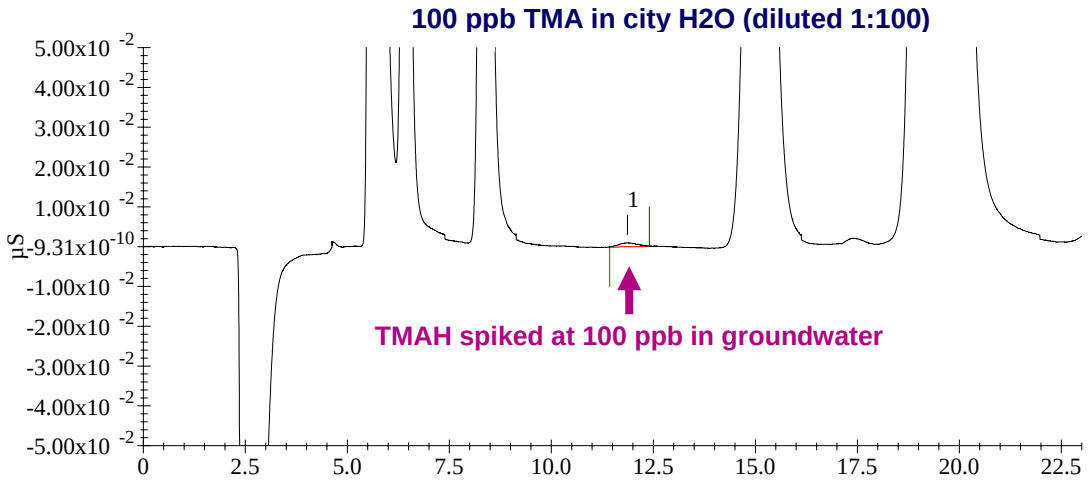
Testing for TMAH in Water

TMAH (Tetramethyl ammonium hydroxide) is an organic amine used by the semiconductor industry in a wide number of applications, including photolithography development, wafer cleaning, silica etching, and in CMP slurries. TMAH is widely used because it provides a basic pH solution with no mobile ions, such as Na^+ or K^+. TMAH is also available in high purity semiconductor grade, with low metallic and anionic contamination.

As such, TMAH can wind up in water post process, causing potential areas of concern in reclaim, reuse, wastewater, and groundwater. Balazs has developed analytical methodology that allows for testing TMAH in different grades of water from ppt to ppm concentrations.



Aqueous samples are collected into bottles and shipped overnight to our Fremont laboratory. Using chromatography, Balazs can identify TMAH from common potentially interfering cations including sodium, ammonium, magnesium and calcium and all other amines including trimethylamine.

Using this procedure, Balazs clients have:

- Characterized TOC in waste streams for reclaim/reuse
- Optimized Membrane Biological Reactor (MBR) waste reduction systems
- Detected improper tool hookups that unknowingly discharged TMAH
- Demonstrated that local groundwater is not contaminated with TMAH

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