

Chlorine Compound Analysis Applications [OMA-300-Cl₂]

Applied Analytics Application Note No. DS-001C — Revised 24 June 2013



Application Summary

Available Analytes: Cl₂, ClO₂, FeCl₃, NCl₃, TiCl₄, VOCl₃, more

Detector: OMA-300 Process Analyzer (using UV-Vis dispersive absorbance spectrophotometer)

Introduction

Various industrial processes require continuous monitoring of chlorine compounds' concentrations for healthy operation. The connecting concern between all of these applications is that the monitoring instrument is proofed against the highly corrosive chlorine compounds which will be present in the sample. Additionally, as some of these compounds are notorious for toxicity and/or explosiveness, chlorine compound analysis systems must be designed to prioritize operator safety.

OMA Benefits

- » Continuously measures up to 5 chemicals' concentrations using dispersive UV-Vis absorbance spectroscopy
- » Totally solid state build with no moving parts — modern design for low maintenance
- » Ultra-safe fiber optic design with dedicated sample flow cell — no toxic/corrosive sample fluid in analyzer enclosure
- » Long-lifespan xenon light source (avg. 5 years)
- » Custom (per-application) sample conditioning design with Teflon wetted parts to withstand long-term corrosion
- » Decade of field-proven performance in the world's harshest industrial environments

Chlorine Compound Analysis Applications [OMA-300-Cl₂]

Applied Analytics Application Note No. DS-001C — Revised 24 June 2013

Monitoring Ferric Chloride (FeCl₃) and Chlorine (Cl₂) in PVC Precursors

Ethylene dichloride (EDC) is the first intermediate in the manufacturing of the versatile plastic PVC from raw materials. Heated to 500 °C in a cracking furnace, EDC splits into VCM (the precursor to PVC) and recyclable HCl.

The EDC entering the furnace sometimes contains ferric chloride (the catalyst used to chlorinate ethylene in creating EDC; this contamination is far from trivial as trace FeCl₃ is known to foul the furnace. Furthermore, PVC made from EDC with impurities (i.e. low levels of chlorine) does not meet the specifications of high-quality PVC and will get rejected by the purchaser.

Solution: the **OMA** is ideal for measuring low concentrations of contaminants in the EDC feed stream and protecting end product quality.

Monitoring Nitrogen Trichloride (NCl₃) in Chemical Production

Most chlorine and caustic soda is produced through electrolysis of sodium chloride brine. Chloride ions in the solution become elemental chlorine at the cathode and caustic soda and hydrogen are produced at the anode. Subsequent liquefaction of chlorine involves scrubbing and cooling to purify the chlorine from various contaminants; among these contaminants is NCl₃ (nitrogen trichloride), formed from reactions between chlorine and nitrogen compounds in salts and additives.

As an explosive sensitive to light, heat, and organic compounds, NCl₃ accumulation presents an enormous safety concern. Plants typically control NCl₃ concentrations to well below 1%, which is the lower explosive limit (LEL) of NCl₃ in air. In the scrubbing and cooling process, chlorine gas is added in order to evaporate the liquid chlorine and leave NCl₃ remaining in the solution. This NCl₃-rich stream is sent to the thermal decomposer, where NCl₃ is dissolved in CCl₄ and broken down.

The traditional NCl₃ concentration monitoring method is Kjeldahl analysis, a lab method with origins in the 19th century. Features of this method include slow and infrequent measurements, high costs, and labor-intensive operation.

Solution: the **OMA** is an always-online analyzer of real-time NCl₃ concentration in the process stream. This capability allows for tight control of the scrubbing/cooling process, proactive reduction of resource waste (e.g. CCl₄ solvent), and early indication of potential safety problems.

Monitoring Titanium Tetrachloride (TiCl₄) and Vanadium in Titanium Oxide Pigment Production Process

Known in the paint industry as the “whitest white,” titanium oxide is a pigment used worldwide. In the chloride production method, titanium ore is converted to TiCl₄, from which metallic chloride impurities are discarded. Oxidation of purified TiCl₄ yields bright, finish-ready TiO₂.

There are two critical analysis applications in this process that immediately improve yield:

- (1) Ensuring that the TiCl₄ is vanadium-free to protect pigment quality
- (2) Monitoring effluent from the oxidation vessel for unreacted TiCl₄ (verify reaction efficiency)

Solution: the **OMA** is perfectly suited for this application due to strength in multi-component analysis and stream multiplexing capabilities. A single system can monitor both TiCl₄ and vanadium simultaneously in multiple streams.

Chlorine Compound Analysis Applications [OMA-300-Cl₂]

Applied Analytics Application Note No. DS-001C — Revised 24 June 2013

The specifications below represent performance of the OMA-300 Process Analyzer in chlorine compound analysis applications.

For technical details about the OMA-300 Process Analyzer, see the data sheet:

http://www.a-a-inc.com/documents/AA_DS001A_OMA300.pdf

All performance specifications are subject to the assumption that the sample conditioning system and unit installation are approved by Applied Analytics. For any other arrangement, please inquire directly with Sales.

Subject to modifications. Specified product characteristics and technical data do not serve as guarantee declarations.

Application Data	
Performance Specifications	
Accuracy	<p><i>All measurement ranges can be customized. Example ranges shown below.</i></p> <p>Cl₂ 0-100 ppm: ±5 ppm 0-10,000 ppm: ±2% full scale or 5 ppm** 0-100%: ±2% full scale</p> <p>TiCl₄ 0-2,000 ppm: ±15 ppm 0-10,000 ppm: ±1% full scale</p> <p>FeCl₃ 0-300 ppm: ±1% full scale 0-10,000 ppm: ±1% full scale</p> <p>NCI₃ 0-100 ppm: ±5 ppm 0-10,000 ppm: ±1% full scale 0-5%: ±1% full scale</p> <p>Vanadium 0-5 ppm: ±0.3 ppm</p> <p style="text-align: right;">**Whichever is larger</p>

Chlorine Compound Analysis Applications [OMA-300-Cl₂]

Applied Analytics Application Note No. DS-001C — Revised 24 June 2013

Further Reading

Subject	Location
OMA-300 Process Analyzer Data sheet	http://www.a-a-inc.com/documents/AA_DS001A_OMA300.pdf
Advantage of Collateral Data Technical Note	http://www.a-a-inc.com/documents/AA_TN-202_CollateralData.pdf
Multi-Component Analysis Technical Note	http://www.a-a-inc.com/documents/AA_TN-203_MultiComponentAnalysis.pdf



is a registered trademark of Applied Analytics Group BV. | www.a-a-inc.com

Headquarters + Manufacturing

Applied Analytics, Inc.
Burlington, MA | sales@a-a-inc.com

North America Sales

Applied Analytics North America, Ltd.
Houston, TX | sales@appliedanalytics.us

Europe Sales

Applied Analytics Europe, SpA
Milan, Italy | sales@appliedanalytics.eu

Asia Pacific Sales

Applied Analytics Asia Pte. Ltd.
Singapore | sales@appliedanalytics.com.sg

Middle East Sales

Applied Analytics Middle East (FZE)
Sharjah, UAE | sales@appliedanalytics.ae

Brazil Sales

Applied Analytics do Brasil
Rio de Janeiro, Brazil | sales@aadbl.com.br

India Sales

Applied Analytics (India) Pte. Ltd.
Mumbai, India | sales@appliedanalytics.in

© 2013 Applied Analytics Group BV. Products or references stated may be trademarks or registered trademarks of their respective owners. All rights reserved. We reserve the right to make technical changes or modify this document without prior notice. Regarding purchase orders, agreed-upon details shall prevail.