

## Titanium Dioxide Manufacturing – AAI Sales Information

### BACKGROUND:

Titanium Dioxide is a pure white powder. It is used as a white pigment in many commercially available products. Titanium Dioxide is used in paints, plastics, paper, printing ink, pharmaceutical, food and cosmetics.

The manufacturing of the pure Titanium Dioxide pigment starts with an impure titanium dioxide found in minerals and sand. Going from impure to pure Titanium Dioxide ( $\text{TiO}_2$ ) involves converting the  $\text{TiO}_2$  to another chemical, separating out the impurities, and then converting back to  $\text{TiO}_2$ .

There are two ways this is done, the chloride process and the sulphate process. The applications we are concerned with are found within the chloride process, so we will only cover that.

### THE CHLORIDE PROCESS:

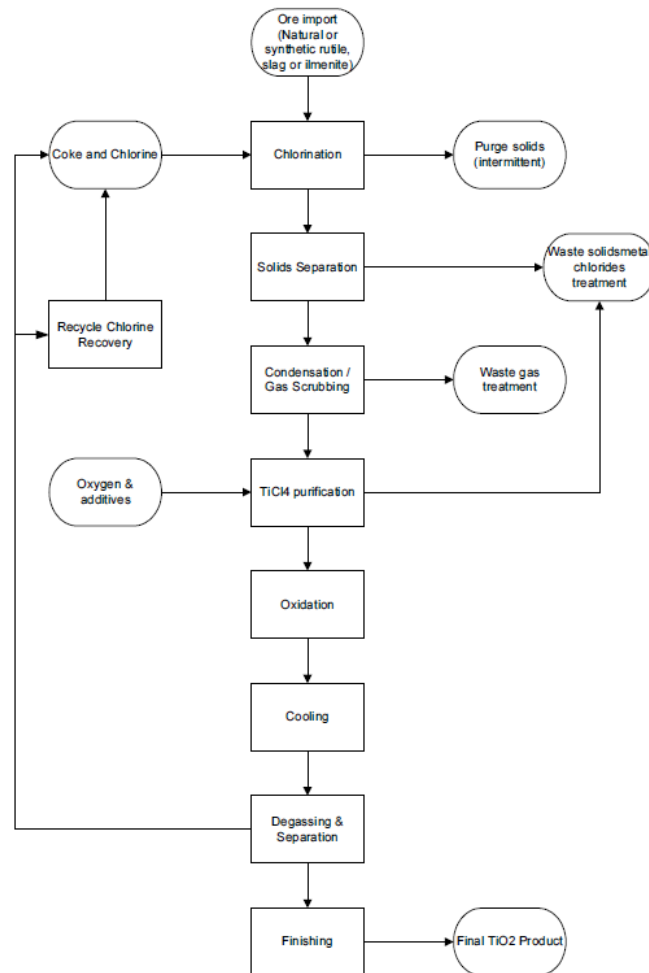
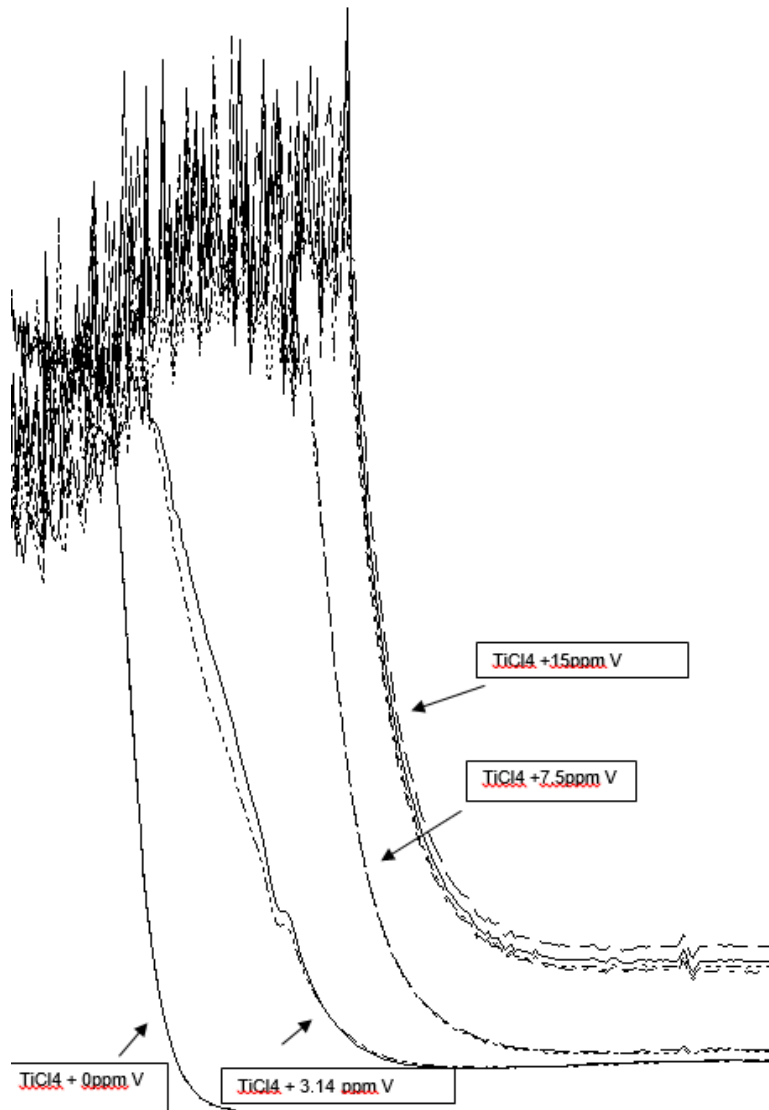


FIG. 2: The chloride process  $\text{TiO}_2$  production route

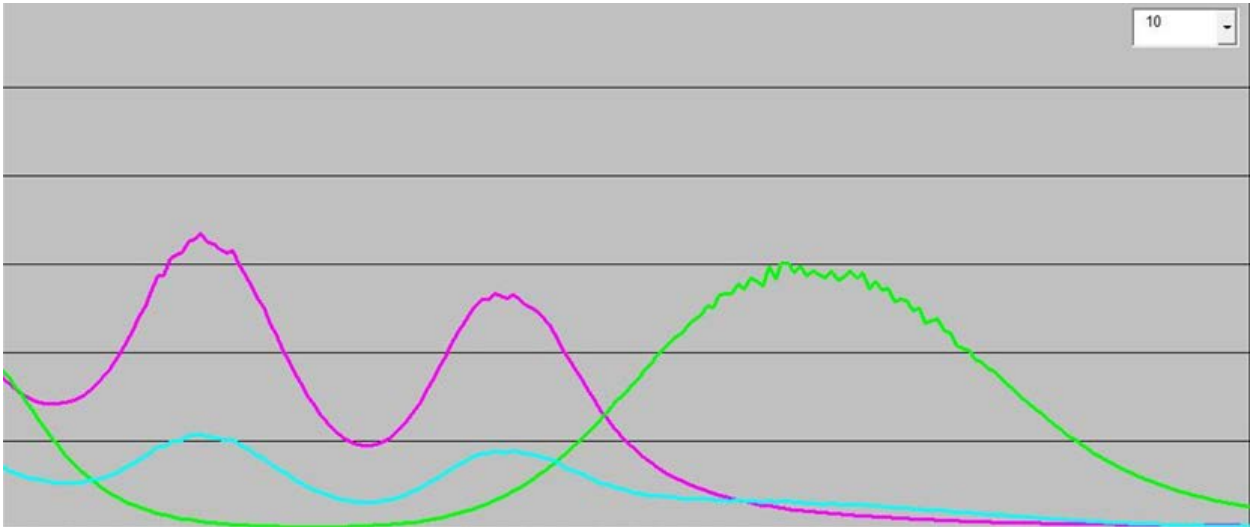
## APPLICATIONS:

There are a few points where the OMA-300 can be applied in the chloride process.

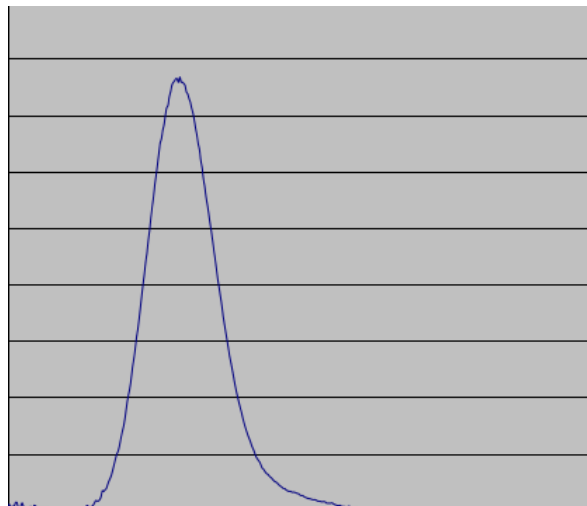
1. The purity of the  $\text{TiCl}_4$  will ultimately reflect the purity and quality of the  $\text{TiO}_2$ . The  $\text{TiCl}_4$  goes through 3 stages of purification, fractional condensation, double distillation and then chemical treatment. The final stage of purification (chemical treatment) is to remove vanadium. After the final stage of purification, the quality of  $\text{TiCl}_4$  can be checked by measuring the amount of vanadium still remaining. The concentration of Vanadium in  $\text{TiCl}_4$  in the 0-20ppm range can be measured by the OMA-300.



2. The waste gas the results from the condensation of  $\text{TiCl}_4$  produces  $\text{CO}$ ,  $\text{CO}_2$  and  $\text{N}_2$ , along with small amounts of  $\text{TiCl}_4$  and  $\text{Cl}_2$ . That waste gas is treated using water and caustic solutions prior to venting to atmosphere. Depending on location, environmental agencies may regulate the concentration of  $\text{TiCl}_4$  or  $\text{Cl}_2$  gas that is vented to atmosphere. The OMA-300 can measure  $\text{TiCl}_4$  and  $\text{Cl}_2$  simultaneously in the ranges of 0-50ppm and 0-300ppm, respectively.



3. After the  $\text{TiCl}_4$  is purified, it is then oxidized to produce  $\text{TiO}_2$ . This creates an off gas which consists of mainly of  $\text{Cl}_2$ , with some  $\text{O}_2$ . The chlorine gas is then recycled to the chlorinator to react with the new  $\text{TiO}_2$  feedstock. The  $\text{Cl}_2$  conversion rate is high (98-100%), but is not perfect, which means that additional fresh  $\text{Cl}_2$  is required to account for the loss of  $\text{Cl}_2$  during the process. Measuring the  $\text{Cl}_2$  concentration in the recycle gas would give an indication of how much fresh  $\text{Cl}_2$  needs to be added during chlorination. The OMA-300 can measure  $\text{Cl}_2$  in the 90-100% range.



END USER LOCATION:

Below is a list of the companies that produce TiO<sub>2</sub>, along with the location, sorted by country. However, not all of these manufacturing facilities will be using the Chloride process.

<b>Name</b>	<b>Location</b>	<b>Country</b>
Cristal Australind Plant	Australind, Australia	Australia
Cristal Kmerton Plant	Australind, Australia	Australia
Tronox TiO <sub>2</sub> Manufacturing Facility	Kwinana, Australia	Australia
Kronos Manufacturing Facility	Langerbrugge, Belgium	Belgium
Cristal Bahia Plant	Rodovia, BZ	Brazil
Cristal Paraiba Plant	Rodovia, BZ	Brazil
Kronos Manufacturing Facility	Varenes, Canada	Canada
Huntsman Pigments and Additives, manufacturing	Guangdong, China	China
Huntsman Pigments and Additives, manufacturing	Shanghai, China	China
Huntsman Pigments and Additives, manufacturing	Jiangsu, China	China
Precheza A.S.	Prerov, Czech Republic	Czech Republic
Huntsman Pigments and Additives, manufacturing	Pori, Finland	Finland
Cristal Thann Plant	Thann, FR	France
Huntsman Pigments and Additives, manufacturing	Comines Cedex, France	France
Huntsman Pigments and Additives, TiO <sub>2</sub> manufacturing	Calais Cedex, France	France
Huntsman Pigments and Additives, manufacturing	Rodgau, Germany	Germany
Huntsman Pigments and Additives, manufacturing	Duisburg, Germany	Germany
Huntsman Pigments and Additives, manufacturing	Krefeld, Germany	Germany
Huntsman Pigments and Additives, manufacturing	Schwarzheide, Germany	Germany
Huntsman Pigments and Additives, manufacturing	Walluf, Germany	Germany
Huntsman Pigments and Additives, manufacturing	Ibbenburen, Germany	Germany
Kronos Manufacturing Facility	Leverkusen, Germany	Germany
Kronos Manufacturing Facility	Nordenham, Germany	Germany
Huntsman Pigments and Additives, manufacturing	Torino, Italy	Italy
Tayca	Okayama, Japan	Japan
Cristal Manufacturing Facility	Yanbu, KSA	KSA
Huntsman Pigments and Additives, manufacturing	Kemaman, Malaysia	Malaysia
Huntsman Pigments and Additives, manufacturing	Selangor, Malaysia	Malaysia
Chemours TiO <sub>2</sub> manufacturing	Altamira, Mexico	Mexico
Kronos Manufacturing Facility	Fredrikstad, Norway	Norway
Kronos Manufacturing Facility	Hauge i Dalane, Norway	Norway
Grupa Azoty Zaklady Chemiczne Police S.A. Manufacturing Facility	Police, Poland	Poland
Huntsman Pigments and Additives, TiO <sub>2</sub> manufacturing	NOT LISTED	Russia

Cinkarna Production Unit	Kemija Mozirje, Slovenia	Slovenia
Huntsman Pigments and Additives, TiO2 manufacturing	Kwazulu Natal, S.A.	South Africa
Huntsman Pigments and Additives, TiO2 manufacturing	Huelva, Spain	Spain
Chemours TiO2 manufacturing	Kuan Yin, Taiwan	Taiwan
Huntsman Pigments and Additives, manufacturing	Schiphol	The Netherlands
Tronox TiO2 Manufacturing Facility	Rotterdam Botlek	The Netherlands
Huntsman Pigments and Additives, manufacturing	Sudbury, UK	United Kingdom
Huntsman Pigments and Additives, TiO2 manufacturing	Hartlepool, UK	United Kingdom
Huntsman Pigments and Additives, manufacturing	Trent, UK	United Kingdom
Huntsman Pigments and Additives, manufacturing	Durham, UK	United Kingdom
Huntsman Pigments and Additives, manufacturing	Wynyard Park, UK	United Kingdom
Cristal Metals Manufacturing Facility	Ottawa, IL	USA
Cristal Metals Research Center	Lockport, IL	USA
Cristal Research Center	Glen Burnie, MD	USA
Cristal Ashtabula Plant 1	Astabula, OH	USA
Cristal Ashtabula Plant 2	Astabula, OH	USA
Huntsman Pigments and Additives, TiO2 manufacturing	Woodlands, Tx	USA
Kronos Manufacturing Facility	Lake Charles, LA	USA
Tronox TiO2 Manufacturing Facility	Hamilton, MS	USA
Chemours TiO2 manufacturing	DeLisle, MS	USA
Chemours TiO2 manufacturing	Johnsonville, TN	USA