

Continuous Monitoring of Vanadium Oxytrichloride Impurities during the Manufacture of TiO₂

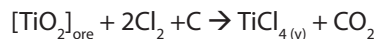
Titanium tetrachloride (TiCl₄) is an intermediate in the production of titanium dioxide (TiO₂) as well as titanium metals and alloys. TiO₂ is a white pigment used primarily in the paint, plastic and paper industries for its superior ability to completely mask a substrate

Measurement Requirement

TiCl₄ purity is monitored in the manufacture of TiO₂. The presence of vanadium, in the form of vanadium oxytrichloride, VOCl₃ in TiCl₄ is an impurity that affects the quality of the TiO₂. The AMETEK IPS-4 Diode Array Spectrophotometer can be used to monitor VOCl₃ in TiCl₄ production, with typical ranges either in 0-20 ppmW or 0-40 ppmW VOCl₃ in TiCl₄.

Process Overview

TiO₂ is primarily manufactured using the chloride process, during which rutile (mostly TiO₂) is converted to TiCl₄ by reacting the ore with Cl₂ gas around 900°C.



Next, other trace metal chlorides are removed using fractional distillation to refine the TiCl₄.

Vanadium oxytrichloride (VOCl₃) is a common impurity that is difficult to remove. Because the quality of the TiCl₄ produced directly affects the quality of the TiO₂ pigment and titanium metal, it is important to monitor TiCl₄ purity.

Finally, the TiCl₄ is oxidized to produce pure TiO₂



The AMETEK IPS-4 Diode Array Spectrophotometer, a full spectrum analyzer, is well suited for this measurement. After collecting the spectrum the on-board computer performs a full spectrum analysis in the determination of VOCl₃ in TiCl₄.

The total time measurement and calculations is less than 4 seconds. The multivariate calibration accounts for specific interferences caused by the sample stream. The IPS-4 is capable of monitoring specific wavelengths and performing multi-component analysis. For this application, measurements are taken between 365 and 450 nm to avoid inherent interferences of the process.

The IPS-4's unique flow cell design separates the process sample from the spectrophotometer, simplifying installation and eliminating any possibility of sample damage to the electronics.



AMETEK's IPS-4 Diode Array Spectrophotometer

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