Application Note

Measurement of Carbon and Sulfur in Titanium Oxide

Alain Salaville, Jérôme Barraqué, Application Laboratory, Longjumeau, FRANCE

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1 Introduction

Titanium oxide are used primarily in the production of paints and plastics and are also used in paper, printing inks, cosmetics, textiles and foodstuffs. Titanium oxide is the most commonly used pigment in the world, giving end products their brilliant whiteness, opacity and protection.

However, it is important to control the air emissions. The producers have to know the Carbon and the Sulphur concentrations as the main air emissions are Carbon monoxide and Sulphur oxides and particulates.

2 Instrumentation

2.1 Principle

The test was performed on the model EMIA 820V. The measurement principle is shown in Figure 2.
The sample is placed in a ceramic crucible in a high frequency induction furnace. The sample is heated at a programmable temperature. Gases produced during the combustion are then analyzed using four Infrared detectors, after dust and moisture removal. The analysis of SO_2 determines sulfur concentration. The analysis of low and high CO_2 and CO determine carbon concentration.

Figure 1: EMIA 820V

2.2 Unique Features

2.2.1 - Programmable Temperature Curves

The high frequency or induction furnace is equipped with a plate current control function. This allows users to easily optimize the temperature according to the samples. Some customized temperature curves can be created in order to observe various phenomena such as surface contamination and different phases or forms of carbon and sulfur.

2.2.2 - Direct gas analysis without conversion

Four Infrared analyzers (NDIR) are used to directly analyze CO, CO_2 and SO_2 over the full range of concentrations. No converter is used nor cellulose filter to trap SO_3 generated in the converter.

2.2.3 - Computer System

All EMIA Series Analyzers are operated by a separate computer system. The software is compatible with Windows 95/98/2000/NT/XP. It includes several functions such as maintenance, diagnostis, statistical studies, curve and data traceability, etc.

2.2.4 - Automatic Cleaning

The double Auto Cleaner option features two brushes to simultaneously clean the combustion tube and the cylindrical dust filter after each measurement. The dust is removed to the dust box by a difference in pressure, which avoids the need for an

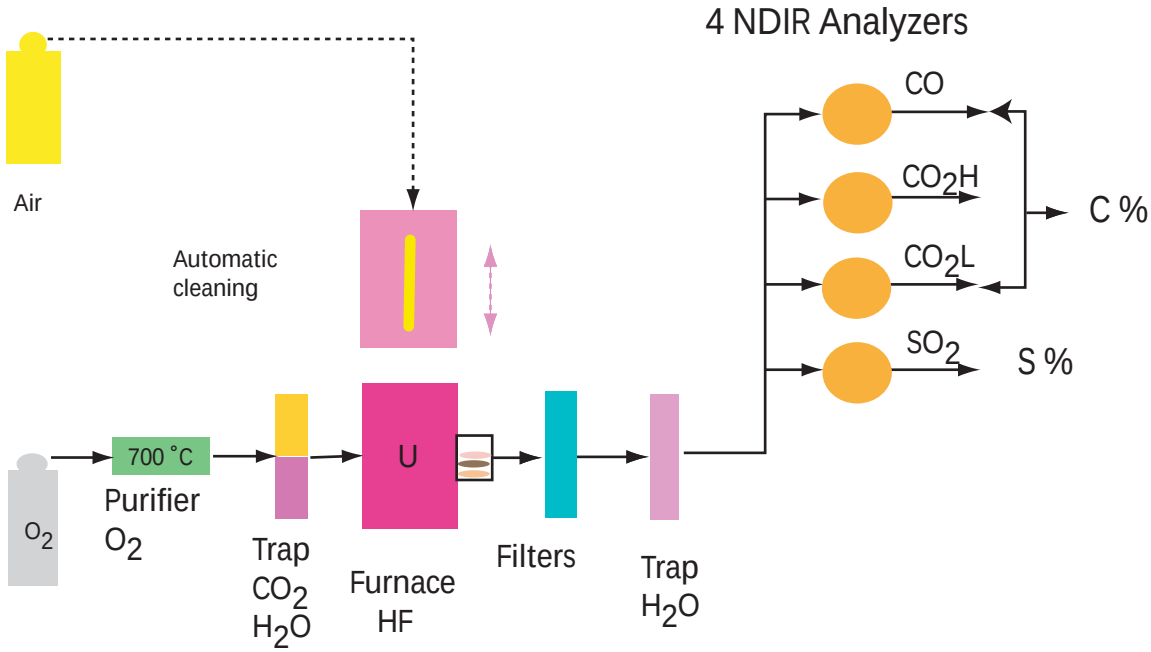

Figure 2: Operating principle

3 Sample preparation

The sample was in the form of a powder.

1. Weigh 0.1 g of sample into a ceramics crucible preburned previuosly in another furnace.

2. Weigh 0.5 g of pure iron, 1.5g of Tungsten and 0.3 g Tin as accelerator, And cover the sample with each metal.

4. Set the ceramic crucible with sample on the crucible stand, and press the [START] button to start analysis.

4 Conditions of analysis

Table 1: Operating conditions

	Start power (mA)	End power (mA)	Time from start to end power (sec)
Step 1	0	175	5
Step 2	175	175	35

	Carbon	Sulfur
Purge time	15 sec	15 sec
Integration wait time	5 sec	5 sec
Integration time	60 sec	70 sec
Comparator level	1.0 %	2.0 %
Comparator wait time	15 sec	20 sec

5 Calibration

1. Set up the system to the analytical condition for the steel in the operator's instruction manual.

2. Calibrate the system following the procedure in the operator's instruction manual.

3. Weigh 1.5g of Tungsten and 0.3g of Tin as blank into a ceramics crucible baked previously by another furnace. Enter 1.0g as sample weight for blank analysis. Repeat measurement 3 times at minimum.

4. Weigh 1.0g of JSS 670-1 (C: 0.013 mass%, S:0.0007mass%) into a ceramics crucible baked previously by another furnace. And cover the sample with 1.5g of Tungsten and 0.3g of Tin. Repeat measurement 3 times at minimum.

5. Change sample analysis condition to the above table condition.

6. Compensate the blank signal because analytical condition to steel standard sample and Titanium Oxide is different. (As for the details, refer to the content of the blank shift of the instruction manual.)

7. Weigh 0.5g of Pure Iron, 1.5g of Tungsten and 0.3g of Tin in the crucible. Enter 0.1g as sample weight for blank analysis. Repeat measurement 3 times at minimum.

6 Results on titanium oxide

Table 2: Titanium Oxide

Weight (g)	Carbon (mass%)	Sulfur (mass%)
0.102	0.0046	0.0068
0.109	0.0038	0.0061
0.104	0.0039	0.0072
0.108	0.0041	0.0077
0.107	0.0035	0.0071
Average	0.0040	0.0070
Standard Deviation	0.0004	0.0006
RSD(%)		
Range	0.0011	0.0016

7 Summary

Instrument: EMIA-820V C/S Determinator

Calibration: JSS 670-1 (C: 0.013 mass%, S: 0.0007 mass %) 1.0 g

Sample: Titanium Oxide
Type: Powder
Weight: 0.1 g

Accelerator: Pure iron (P/N 905.110.300.001) 0.5g
Tungsten (P/N 905.110.140.001) 1.5g
Tin (P/N 905.202.200.001)0.3g

Crucible: Ceramic (P/N 905.202.200.001)

Crucible Preburning: Crucible Preburning unit (FK-10)

8 Conclusion

Carbon and Sulfur measurement in Titanium Oxide samples is compatible with the EMIA 820 V Series equipped with a high frequency furnace. The extraction is complete and efficient in all cases, and the results are repeatable.

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In the USA:
HORIBA Jobin Yvon Inc.
3880 Park Avenue
Edison, NJ 08820
Tel: 1-732-494-8660
Fax: 1-732-494-8796
E-mail: info@jobinyvon.com

In France:
HORIBA Jobin Yvon S.A.S.
16-18, rue du Canal
91165 Longjumeau Cedex
Tel: (33) 1/64 54 13 00
Fax: (33) 1/69 09 90 88

Germany: (49) 89/46 23 17-0
Italy: (39) 2/57 60 56 90
U.K.: (44) 20/82 04 81 42

In Japan:
HORIBA Ltd.
2 Miyanohigashi, Kisshoin
Minami-ku, Kyoto 601-8510
TEL: (81) 75 313 8121
FAX: (81) 75 321 5725
www.jyhoriba.jp

China: (86) 10/6849 22 16
Spain: (34) 91/724 16 57
Other Countries: Contact H JY S.A.S.

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