
PILOT ROTARY KILN EVALUATION OF GREEN COKE

PREPARATION AND TEST METHODS

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Table of contents

1	INTRODUCTION	2
3	GREEN COKE TESTING	2
4	SAMPLE PREPARATION	3
5	PILOT ROTARY KILN CALCINATION	3
5.1	KILN DESCRIPTION	3
5.2	CALCINATION OF GREEN COKE	4
6	STATIC CALCINATION	4
7	CALCINED COKE TESTING	5

1 Introduction

R&D Carbon (RDC) is equipped in its pilot plant with a special pilot rotary kiln for the evaluation of green cokes. The full pilot rotary kiln evaluation described in this document includes the determination of the green coke quality, the losses during calcination and the final calcined coke quality that can be achieved.

The green coke quality will be determined by the measurement of its typical properties.

The calcination of the material will be made in two steps. The first one will be the calcination up to 750°C in the pilot rotary kiln in order to remove the volatiles present in the green coke. The second one will be the static calcination of the pre-calcined material in order to reach a typical real density.

The final calcined coke quality will then be determined by measuring all typical properties after rotary kiln and static calcination.

2 Green Coke Testing

Minimum 60 kg of a representative green coke is needed for a complete evaluation. This sample will be firstly divided to produce a 5 kg sample which will be tested in the R&D Carbon laboratory. The properties shown in the table below will be performed.

Pos	Properties	Unit	Method	Method RDC
1	Water Content Coke	%	ISO 11412	M204
2	Volatile Matter	%	ISO 9406	M175
3	Hardgrove Grindability Index	-	ISO 5074	M196
4	Sieving Analysis	%	ISO 12984	M111
5	Elements XRF	%, ppm	ISO 12980	M103-1
6	Ash Content	%	ISO 8005	M169-1

Figure 1: Properties of Green Coke

3 Sample Preparation

The sample will be firstly dried at 200°C in order to prepare the coke fraction < 16 mm that will be used for the evaluation. After sieving, the material > 16 mm will be crushed and sieved again until all the material is < 16 mm. The crushed fractions will be added to the natural ones and the sample will be homogenized.

4 Pilot Rotary Kiln Calcination

4.1 Kiln Description

R&D Carbon is equipped with a continuous pilot rotary kiln unit using green coke sized at < 16 mm. The 4.5 m length kiln is electrically heated at 750°C and his internal pipe diameter is 25 cm. The off-gases are removed with a draft which is applied to the kiln. The throughput, regulated by the inclination of the furnace and the rotational speed of the heat-resistant pipe, is 20 kg/h.



Figure 2: EXT 114 Pilot Rotary Kiln

4.2 Calcination of Green Coke

60 kg of the prepared fraction < 16 mm of green coke will be pre-calcined in the EXT 114 Pilot Rotary Kiln described above to a temperature up to 750°C with a rate of 20 kg/h.

5 Static Calcination

The rotary kiln calcined coke, where the volatiles have been removed, will be calcined at a finishing temperature of 1'125°C in order to reach the final real density. The final calcination will be made in the BF24 baking furnace with the following program:

- RT to 200°C: 200°C/h
- 200°C to 800°C: 100°C/h
- 800°C to 1'125°C: 50°C/h
- Soaking Time at 1'125°C: 20 hours



Figure 3: RDC 167 Pilot Baking Furnace BF24

6 Calcined Coke Testing

The calcined coke after final static calcination will be divided in order to obtain the 5 kg sample needed for laboratory testing. The following properties will be determined:

Pos	Properties	Unit	Method	Method RDC
1	Sieving Analysis	%	ISO 12984	M111
2	Tapped Bulk Density	kg/dm ³	ISO 10236	M153
3	Grain Stability	%	ISO 10142	M156
4	Pulverizing Factor	-	-	M168
5	Real Density Xylene	kg/dm ³	ISO 8004	M152-1
6	Crystallite Size	Å	ISO 20203	M104
7	Specific Electrical Resistance	μΩm	ISO 10143	M147
8	Air Reactivity Coke 525°C	%/min	ISO 12982-1	M142-1
9	CO ₂ Reactivity Coke	%	ISO 12981-1	M141
10	Elements XRF	%, ppm	ISO 12980	M103-1
11	Ash Content	%	ISO 8005	M169-1
12	Pore Distribution Hg 2000 bar	-	-	M105

Figure 4: Properties of Calcined Coke