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GB/T 33969-2026

Replacing GB/T 33969-2017

Technical specification for oxygen-enriched pulverized coal injection into blast furnaces

高炉富氧喷煤技术规范

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part

1.Structure and Drafting Rules of Standardization Documents". Drafting. This document replaces GB/T 33969-2017 "Technical Specification for Oxygen-Enriched Pulverized Coal Injection in Blast Furnaces". Compared with GB/T 33969-2017, the main differences are in the structural adjustments. Aside from integration and editorial changes, the main technical changes are as follows:

a) The scope has been changed (see Chapter 1, Chapter 1 of the.2017 edition);

b) The terms and definitions for pulverized coal cost-effectiveness, blast furnace economic

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oxygen enrichment rate, and pulverized coal pulverization price have been removed (see section

3.3 of the.2017 edition). 3.4, 3.5);

c) The principles and processes have been changed (see Chapter 4, Chapter 4 of the.2017 edition);

d) Furnace fuel requirements have been changed (see 5.2,.2017 version 5.2);

e) The equipment and safety maintenance requirements have been removed (see Chapter 8 of the.2017 edition);

f) Increased requirements for metering equipment maintenance and intelligent control (see 8.1~8.2);

g) Increased greenhouse gas accounting and emission requirements for oxygen-enriched pulverized coal injection in blast furnaces (see 9.4). Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This document was proposed by the China Iron and Steel Association. This document is under the jurisdiction of the National Steel Standardization Technical Committee (SAC/TC183). This document was drafted by: Beijing University of Science and Technology, Zhongtian Iron and Steel Group Co., Ltd., Shandong Jiuyang Group Co., Ltd., and Jinan Iron and Steel Group Co., Ltd. Limited Liability Company, Yunnan Qujing Chenggang Steel (Group) Co., Ltd., Inner Mongolia Baogang Steel Union Co., Ltd., Beijing Shougang Co., Ltd. Metallurgical Industry Information and Standardization Research Institute, Wuhu Xinxing Cast Pipe Co., Ltd., and Lu'an Chemical Group Co., Ltd. The main drafters of this document are. Zhang Jianliang, Xu Runsheng, Li Kejiang, Wang Jiangwei, Ye Yukui, Xu Bozhang, Wang Shuhua, Lin Bingsheng, and Bai Xiaoguang. Jia Xin, Chen Jian, Gao Changyou, Ma Junxiang, Jiao Kexin, Liu Zhengjian, Qiu Jinhui, Ma Fangqing, Han Huaibin, Li Yanzhi, Yang Lihang, Yang Fan, Wang Ronggang Wei Ruirui, Xu Haidong, Wang Zhenyang, Zhang Ruopeng, Li Yang, Huang Yabin, Zong Yanbing, Yu Jingyao, Yang Xiaoyan, Zheng Zhanbin, Liu Yanxiang, Zhang Yuanchun Li Yuzhu, Wang Rongrong, Yu Hengliang, Guo Zhuotuan, Fu Lijun. This document was first published in.2017, and this is its first revision. Technical Specifications for Oxygen-Enriched Coal Injection in Blast Furnaces

1.Scope This document specifies the principles and procedures of oxygen-enriched pulverized coal injection technology in blast furnaces, as well as the requirements for injected fuel, technical requirements, operating principles, and maintenance of metering equipment. In line with intelligent control and environmental protection requirements. This document applies to the design, operation, management, and equipment maintenance of oxygen-enriched pulverized coal injection technology for blast furnaces in newly built, renovated, and expanded steel enterprises.

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4 Principles and Processes

4.1 Principle The blast furnace tuyeres swirling zone is a finite dynamic space formed by the impact of a high-temperature, high-pressure, high-speed jet, where transient combustion occurs at high temperatures. Combustion and intense turbulent motion. Oxygen-enriched pulverized coal injection (OPO) involves simultaneously injecting pulverized coal and oxygen into the tuyeres of the blast furnace, partially replacing coke with pulverized coal. Ironmaking technology. The injection of pulverized coal causes a decrease in the theoretical combustion temperature of the tuyeres' swirl zone and an increase in the amount of gas, while oxygen enrichment can improve the combustion temperature of the tuyeres' swirl zone. Theoretical combustion temperature, reduced gas volume, compensation for negative metallurgical effects caused by pulverized coal injection, and maintenance of stable blast furnace operation.

4.2 Process Flow The blast furnace oxygen-enriched pulverized coal injection process mainly includes pulverized coal preparation and transportation, oxygen replenishment, tuyere injection, and blast furnace smelting, followed by oxygen enrichment after the blower. The process flow diagram is shown in Figure 1, and the process flow diagram of the oxygen enrichment process before the fan is shown in Figure 2.

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5.1 Requirements for raw coal

5.1.1 The lower heating value of bituminous coal shall not be lower than 26,000 kJ/kg, and the lower heating value of anthracite shall not be lower than 29,000 kJ/kg.

5.1.2 The sulfur content of raw coal shall meet the requirements of GB 50427; the alkali metal content in the ash of raw coal shall be less than 1.0%.

5.1.3 The Hardgrove Grindability Index of raw coal should be 50~90, the angle of repose should be less than 42°, and the jetting and flowability index should be greater than 60.

5.1.4 The raw coal used should be a type of coal that does not coke, and the plastic layer index of bituminous coal should be less than 10 mm.

5.1.5 The moisture content of anthracite should be less than 10%, and the moisture content of bituminous coal should be less than 16%.

5.2 Fuel Requirements for Furnace

5.2.1 After pulverization, the ash melting point of the pulverized coal injected into the blast furnace should be greater than 1250°C, and the moisture content should be less than 2%. Anthracite injection. When using pulverized coal injection, 70% to 80% of the pulverized coal entering the furnace should have a particle size smaller than

0.074 mm; when using full bituminous coal injection, the particle size of the pulverized coal

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entering the furnace should be smaller than

0.074 mm. The ash content should reach 60%~65%. The requirements for ash and sulfur content of pulverized coal entering the furnace for different blast furnaces should comply with the provisions of Table 1.

5.2.2 The particle size of the blast furnace injection coking dust should not be larger than that of the anthracite entering the furnace, and the ash content should not exceed 12%.

5.2.3 When injecting biomass, organic solid waste (waste plastics, waste rubber), or other fuels into the blast furnace, the particle size of the feed material should not exceed that of the bituminous coal, and the moisture content should be... The content should be less than 2%, and the content of ash, alkali metals, chlorine, sulfur and other elements should not exceed the requirements of pulverized coal.

5.2.4 When injecting circulating gas, hydrogen-rich gas, or pure hydrogen gas into a blast furnace, the gas should be purified and pressurized first to meet the requirements for blast furnace injection. Require.

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6.1 General Requirements

6.1.1 Methods for determining the oxygen enrichment rate and pulverized coal injection rate in a blast furnace The oxygen enrichment rate and pulverized coal injection rate in a blast furnace should be determined comprehensively based on furnace volume, raw material conditions, smelting objectives, and techno-economic analysis. This should be achieved through a combination of oxygen enrichment and pulverized coal injection. Coal synergistic optimization aims to achieve stable blast furnace operation, reduce fuel ratio, and increase production while saving energy.

6.1.2 Selection Methods for High-Performance Coal Types The selection of high-performance coal types should involve evaluating the cost-effectiveness of pulverized coal injection, based on the principle of high effective calorific value and high cost-effectiveness index. The method is described in Appendix A.

6.1.3 Optimal Matching Methods for Multiple Coal Types

6.1.3.1 The effective calorific value, combustibility, and volatile matter of the mixed pulverized coal should be within the safe range of the pulverizing and injection system.

6.1.3.2 First, select several coal types with high cost-effectiveness based on the principle of evaluating the cost-effectiveness of pulverized coal; then, based on the safety conditions of the pulverizing and injection systems, determine... The upper limit of volatile matter in pulverized coal is determined, and different coal types are mixed and blended. The mixed pulverized coal is then selected based on the principle of cost-effectiveness evaluation to select the most cost-effective option. Pulverized coal blending scheme.

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