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储能电池技术发展研究浅析

TM912 A 1001-9006 2022 03-0001-04

Latest Technological Developments of Energy Storage Batteries

,

DEC Academy of Science and Technology Co., Ltd., 611731, Chengdu, China

Abstract: With the rapid development of renewable energy, the electrical power system typically suffers from the energy consumption and power supply and demand, which drives the development of electrochemical energy storage. The battery performance directly determines the electrochemical energy storage efficiency. In terms of reserves, safety and life performance, lithium-ion battery cannot require the demand of the new electrical power system. In the future, various batteries with designed and tunable properties together serve the needs for energy storage. Here, we provide an overview of lithium-ion battery, sodium-ion battery, sodium sulfur battery, and all vanadium redox flow battery, supporting the new development of batteries in the electrical power system.

Key words: energy storage battery; lithium-ion battery; sodium-ion battery; sodium sulfur battery; all-vanadium flow battery

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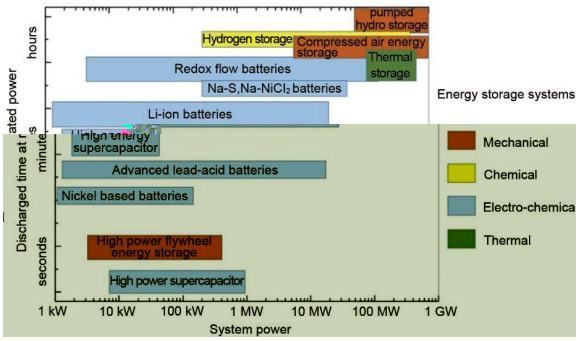
“ ”



1 [1]

2022-06-02

1994 2021

Wh/kg

1 80~90%

12 000

2020 14.2 GW

0.006 5%

/ 1.2

MW

[2]

“ ” 0.102 nm

0.076 nm

1.1

92%

2.75 %

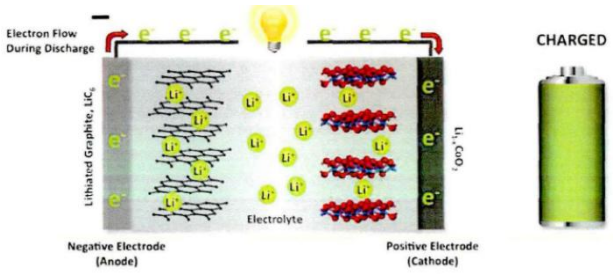
0.006 5 %

“ ” 2

0.55 /Wh

[3-4]

0.2~0.3 /Wh



20 90%

[6-8]

2 [5]

210

Wh/kg, 300

1.3

4 V^{5+}/V^{4+}

3.6 % NGK V^{3+}/V^{2+}

V^{4+} V^{5+} V^{3+} V^{2+}

H^+

β Al_2O_3 1

$VO_2^+ + 2H^+ + e^- — VO^{2+} + H_2O$

3 V^{2+} $e^- — V^{3+}$

1

300~350

Na^+ β

Al_2O_3 S^{2-}

4 [10]

3 [1]

15 000 æ

300~350

[1,9]

1.4

VRB

[12]

4 000 /kWh

1/3~1/2

2

0~45 1

1

%	0.0065	2.75	2.75	0.02
Wh/kg	160~300	120~160	150~240	15~40
	-20~60	-40~80	300~350	0~45
	5~10	5~10	10~15	10~20
/Wh	0.6~1.0	0.5	2.2~3	3~3.2

“ ”

“ ”

[1] , , .
—— [J].

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危险废物等离子体处理技术的应用研究

1 2

X327 A 1001-9006 2022 03-0005-06

Discussion on the Application of Plasma Treatment Technology for Hazardous Waste

1 2

1. DEC Academy of Science and Technology Co.,Ltd., 611731, Chengdu, China;

2. Chengdu Huanfu Technology Co., Ltd., 610213,Chengdu,China

Abstract: The application status of hazardous waste disposal and utilization technology is introduced, and the basic principle and system composition of plasma treatment technology are discussed.This paper focuses on the analysis of the domestic demonstration application of plasma treatment technology d

Tetronics

SNCR

2.1

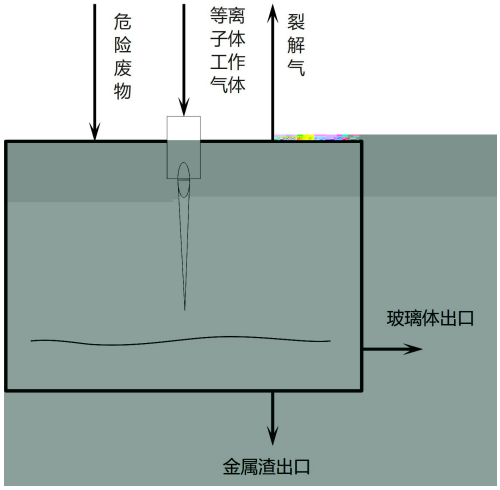
“ ” “ ”

[1]

[2]

1

2020



1

2.2

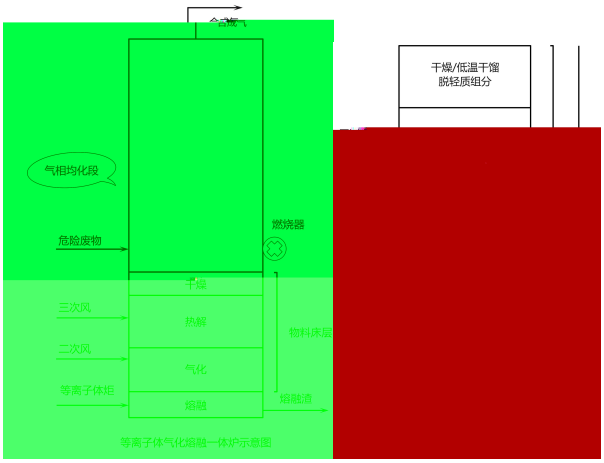
75 /

30 / 40 /

2

8 100 /

1 / 2



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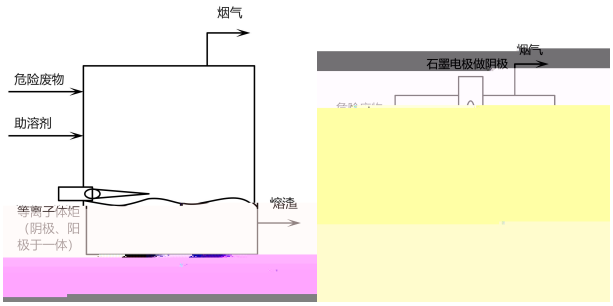


2

2.3

2.3.1

2.3.2

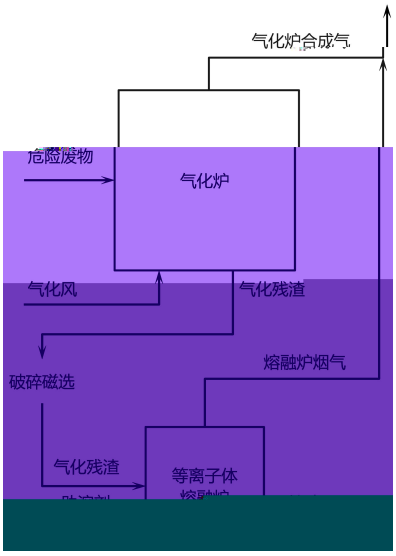
2 /

18

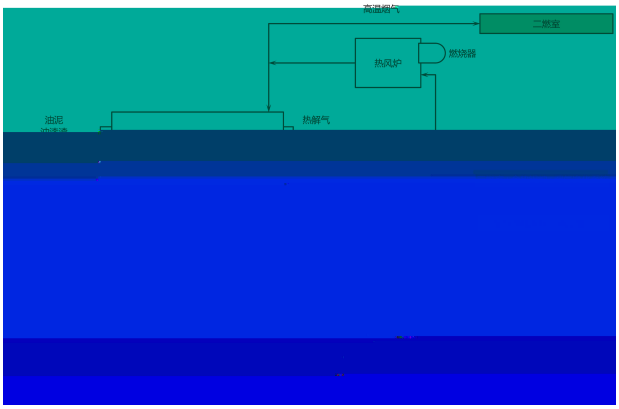
3

0.99 /

4 -



4 -



5

2.5

2.4

3 / 1

5 000 / / 6

5

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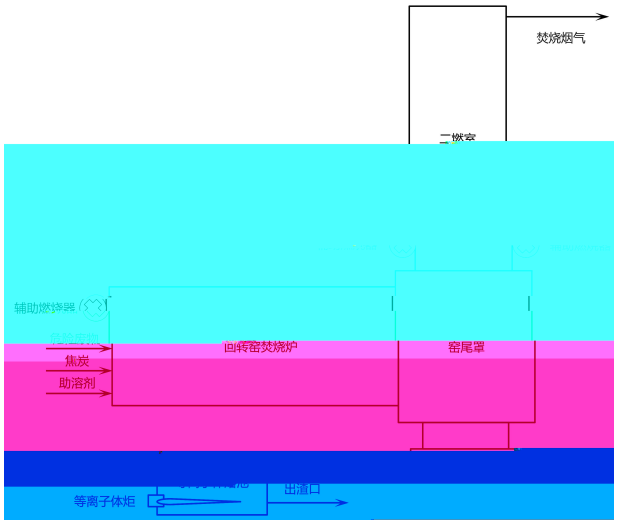
w Ÿ ЏЏЦ ɤn ɳ ɐ



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4

柔性作业车间分批调度问题优化研究进展

1,2 2 2 1 1

TH165 A 1001-9006 2022 03-0011-04

Research Progress on Batch Scheduling Optimization of Flexible Job Shop Problem

1,2, 2, 2, 1, 1

1. DEC Academy of Science and Technology Co., Ltd., 611731, Chengdu, China;

2. Southwest Jiaotong University, 610031, Chengdu, China

Abstract: In order to adapt to the demand transformation of batch production mode for job shop scheduling, the batch scheduling problem of flexible job shop is summarized and prospected. firstly, introduces the flexible job shop batch scheduling problem from the two aspects of problem description and solution strategy secondly summarizes the current research status of flexible job shop batch scheduling problem at home and abroad from the perspective of equal batch and flexible batch; and finally puts forward the problems that need to be further studied and improved, Suggestions for future research work are put forward.

Key words: flexible job-shop scheduling problem; batch scheduling; batch splitting; sorting optimization

Flow-shop Scheduling Problem FSSP Job-shop Scheduling Problem JSP [1]

JSP

2022-03-21

2021YFG0039

1989 2016

1

JSP

Non-deterministic Polynomial,

NP [2]

2

Flexible Job-Shop Scheduling

Problem FJSP JSP

3

[3-5]

FJSP

4

[6] FJSP

5

6

FJSP

Flexible Job-Shop Batch Scheduling Problem 7

FJBSP FJBSP

8

[7]

FJBSP

1.2

①

② ③

1

1.1

N

M

R

2 3

Lei [16]

Buscher [17]

Zhao [18]

Low[8]

Alyne [19]

MIP

2.2

[20]

2.1

[9]

[21]

[10]

Pareto

[11] [22]

[23]

[12]

[24]

[13] Chan FTS [25]

[14]

Andrzej Frank [26]

Wong [15]

Soroush [27]

II

Chen JC Chen TL [28]

1

2

3

[1] , . [J]. , 2020(23):123-124

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基于整数线性优化的蛇形管备料中心智能排料

0.1

NP

[1-3] [4] [5]

[6-8]

[9-11]

[12] [13]

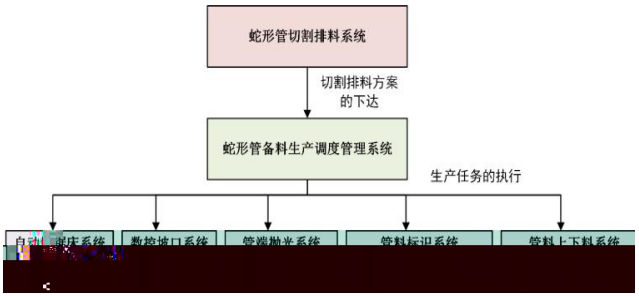
[14]

[15]

[16]

[17]

1



1

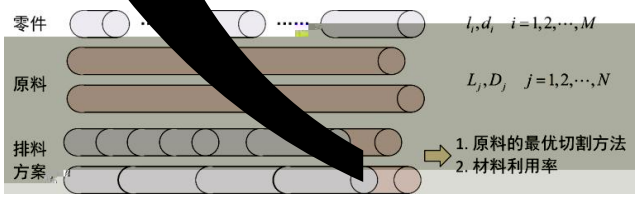
2.1

= ⋯,

…,

$= \quad -\sum_{=1} \times \alpha$

2



2

2.2

$\boldsymbol{P} = \{ \quad \}$

α

$\sum_{=1}$ α

$= [\alpha_1 \ , \alpha_2 \ , \cdots, \alpha \ ]$ ( )

$\geq \sum_{=1} \times \alpha$ (1)

ERP

or-tools

4	10221	3*2824 | 1*1729	2
5	10763	1*1823 | 1*1547 | 2*2824 | 1*1729	3
6	10763	1*2482 | 1*1547 | 1*2824 | 1*1961 | 1*1927	3
7	10763	1*1823 | 1*1391 | 2*2792 | 1*1927	1
8	10763	1*1391 | 2*2792 | 1*1837 | 1*1927	2
9	9414	1*1823 | 1*2824 | 1*1961 | 1*2792	3
10	9414	3*1547 | 1*2824 | 1*1927	1

99.758 % 7.704 08 s

10

5

1

100 $[1200,3000]$

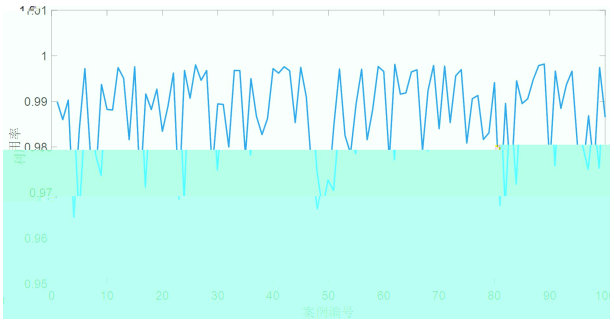
$[1,30]$

$[9000,11000]$ $[1,20]$

1.1

1

1	2482	7	1	9651	1
2	1823	8	2	9642	15
3	1547	13	3	10221	3
4	2824	19	4	10763	9
5	1391	3	5	9414	4
6	1961	24			
7	2792	20			
8	1837	11			
9	1729	5			
10	1927	25			



3

2

100 21

60s

NP-

2

1	9642	1*2482 | 1*1547 | 2*2792	4
2	9642	2*1961 | 1*1837 | 2*1927	9
3	10221	1*1823 | 3*2792	1

100

98. 8 %

99.8 %, 96.5 %

100 60 s

CFB 锅炉燃尽风对氮氧化物排放影响研究

1, 2 1, 2 1, 2 1, 2 1, 2 1, 2 1, 2

NOx

NOx CO

0 % 16 % NOx 137 mg/Nm^3 70 mg/ Nm^3 CFB

CFB

TM621 A 1001-9006 2022 03-0020-04

Research on the Influence of the Burn Out Air on Nitrogen Oxide Emission in CFB Boiler

1,2, 1,2, 1,2, 1,2, 1,2,
1,2, 1,2

1. Clean Combustion and Flue Gas Purification Key Laboratory of Sichuan Province, 611731, Chengdu, China

2. Dongfang Boiler Co., Ltd., 643001, Zigong, Sichuan, China)

Abstract: Due to the need of circulating fluidized bed CFB boiler to further reduce NOx emission, According to the formation and transformation mechanism of NOx in CFB boiler. The effects of bed temperature, oxygen content and burn out air rate on NOx emissions were studied, The effects of burnout air on CO emission and carbon content of fly ash were studied. The results show that burning out air has a significant effect on reducing NOx emission of CFB boiler. When the ratio of exhausted air increased from 0 % to 16 %, and NOx emission value decreased from 137 mg/Nm^3 to 70 mg/Nm^3. Burn out air plays a positive role in maintaining the stability of NOx emission when the oxygen content of CFB boiler fluctuates, It is demonstrated that the burnout air technology has certain advantages in low emission performance of CFB boiler.

Key words: NOx; burn out air; CFB boiler

NOx

NOx

[1-2] (CFB) NOx

3 MW CFB

NOx

[3-4] NOx

CFB

2022-06-23

1986 2010

NOx

CFB

[11-14] NO

NO

[15]

3MW CFB

1 24.5 m

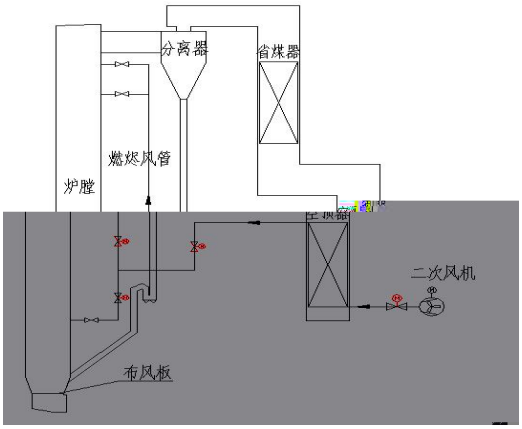
0.9m × 1.1m M

DCS ABB

4.9 m

19.4 m 22.4 m

23.4 m



1

N

N

N[5-8]

N HCN NH_3

HCN NCO NCO

NO N_2O NH_3

NO[9-10]

NO

NO

NO

6.0% 1

1

	t	%	9.2
	ad	%	5.63
	ar	%	33.20
	ar	%	27.44
	daf	%	47.66
	ar	%	30.14
	gr,v,ar	MJ/kg	17.84
	net,v,ar	MJ/kg	16.99
	ar	%	42.95
	ar	%	3.10
	ar	%	0.86
	ar	%	9.27
	t,ar	%	1.40

3.1

2 NOx CO

55 %

880 3.2 %

0 %~16 %

NOx CO

10 %

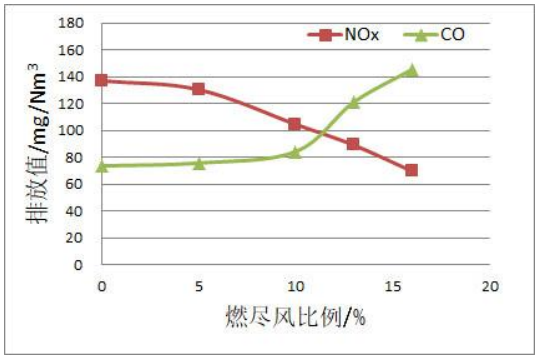
10 % 16 % CO 84 mg/Nm^3

145 mg/Nm^3 0 NOx

137 mg/Nm^3 10.0 % NOx

102 mg/Nm^3

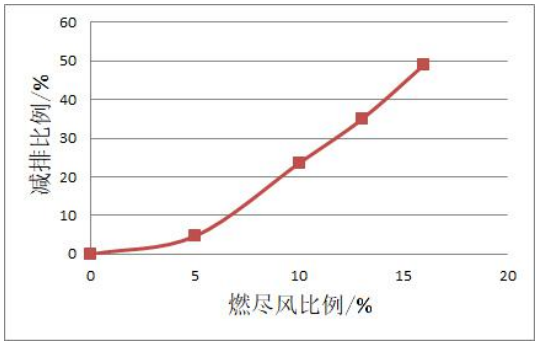
16.0 % NOx 70 mg/Nm^3



2

3 NOx

10 % NOx 25.5 %
16 % NOx 49.1 %
NOx



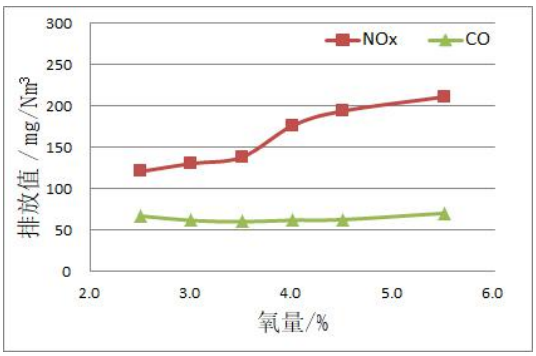
3

3.2

4

55 % 910
3.5 % NOx
3.5 %
5.5 % NOx
CO

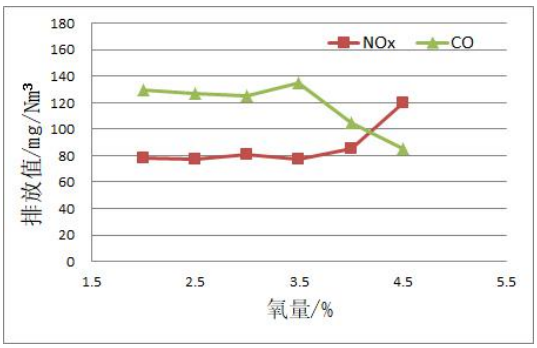
2.5 % NOx 121 mg/Nm^3 3.5 % NOx 138 mg/Nm^3 5.5 % NOx 211 mg/Nm^3 2.5 % 3.5 % NOx 14.4 % 5.5 % NOx 74.7 %



4

5 16 %
55 % 880
NOx
3.5 %
NOx
3.5 % 4.5 % NOx

2.0 % NOx 78 mg/Nm^3
3.5 % NOx 77 mg/Nm^3
4.5 % NOx 120 mg/Nm^3
2.0 % 4.5 % NOx
53.8 %
3.5 % CO 128 mg/Nm^3 3.5 % 4.5 % CO 85 mg/Nm^3



5 16%

3.3 NOx

6 NOx

16 % NOx 10 %
NOx NOx
16 %
10 % NOx

CFB

NOx

2.5 % 4.5 %

NOx 121 mg/Nm^3 194 mg/Nm^3

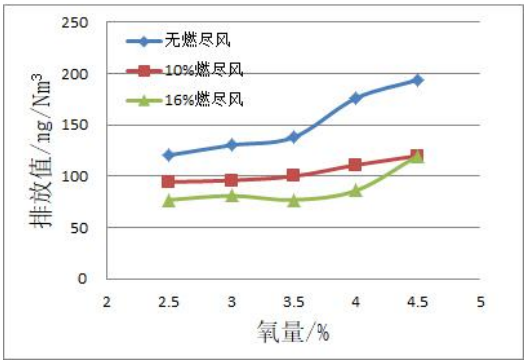
10 % NOx 94 mg/Nm^3

120 mg/Nm^3 16 % NOx

77 mg/Nm^3 120 mg/Nm^3 CFB

NOx

NOx

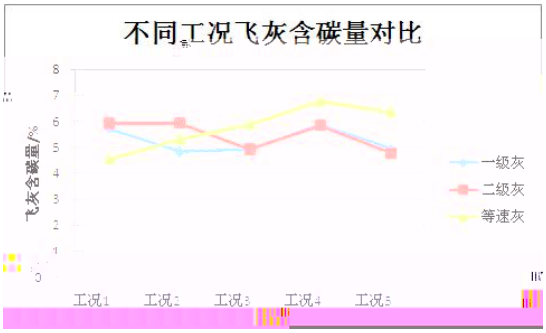


6 NOx

3.4

7

1 10 % 2 16 % 3~5



7

1 NOx

10 % NOx

25.5 16 N

4

NOx

2 3.5 % NOx

3.5 % NOx

3 10 % 16 % NOx

NOx

CFB

NOx

NOx

4 15 %

[1] , , .
[J] , 2016, 49(1):1-13

[2] LYNGFELT A, MANDL E, LECKNE B Reversed air staging method for reduction of N_2O emissions from fluidized bed combustion of coal[J] Fuel, 1998, 77(9):953-959

[3] , . NOx
[J]. , 2015, 46(2):55-59

[4] , , Õ . NOx › Qað U排&) 7 l° / P P4``
, 2015, 31(1):71-72

[5] , , . N_2O PM
[J]. , 1994,14(4):1-7

[6] , . N_2O [J].
, 1997,5(5):2-15

[7] , , . Fe
CO N_2O/NO N_2 [J]. ,
2001, 21(1):44-47

[8] , , . Co-Mg/Al
N_2O [J]. , 2007, 3(2):162-168

[9] , , . N2O
[J]. . 2007, 36(3):303-307

[10] , , . #q N_2Om "NOk
[J]. , 2002,18(2):51-52

[11] , , à €
N_2O [J]. , 2001,1(3):44-47

[12] , , . Y

大型 G115 钢弯头成型工艺研究

G115

G115

G115

TM621 A 1001-9006 2022 03-0024-04

Research on the Forming Process of Large G115 Steel Elbows

Dongfang Boiler Co., Ltd., 643001, Zigong, Sichuan, China

Abstract: This paper mainly expounds the formation of the large G115 steel elbows by,respectively, medium frequency induction heating process and hot extrusion forming process.The control temperatures and the heat treatment process adequate for G115 steel elbow formation are identified through tests of the two process methods, ensuring the technology preparation for the manufacturing of boilers with high-grade parameters.

Key words: G115 steel; hot working forming; process

G115

G115

P92

P92 630

G115

≥ 3

G115

GB/T16507

9Cr3W3Co

G115

620 ~ 650 650

530 mm×115 mm

P92 1.5 G115

1 800 mm 60° 4 028 mm

630

1

1 G115

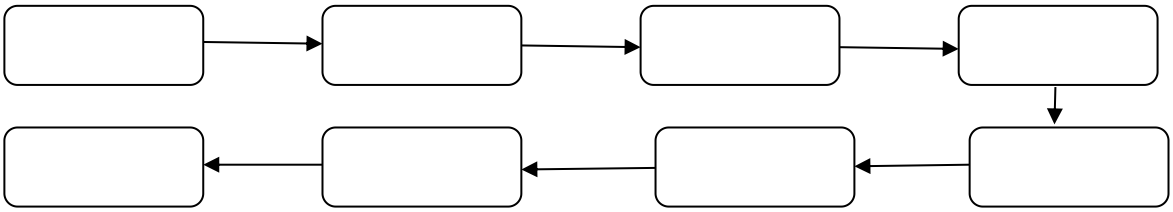
wt%

C	Si	Mn	Cr	Co	W	V	Nb	Cu	B	N	Fe
0.097	0.31	0.43	9.11	2.98	2.67	0.18	0.66	0.85	0.013	0.000 8	Bal

2022-04-12

1980

1.1 1 000 1 060
G115 1 050 900
1 SA-335P91
G115 2



1 G115

2 G115

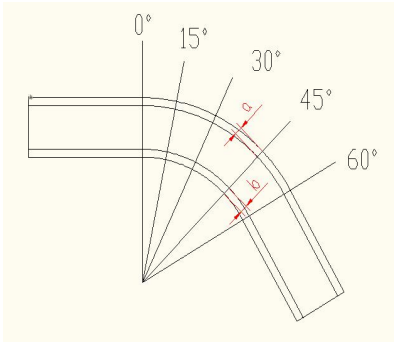
30
1 060
780 ± 15 300+15 min
300 ≤ 150 /h

30

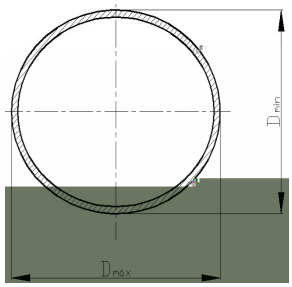
1.2
G115
G115
1070 ± 15 150+15 min
550 ≤ 150 /h

1.3
G115
2

2 G115 530 mm×115 mm; 1800



% : ≤ allowed



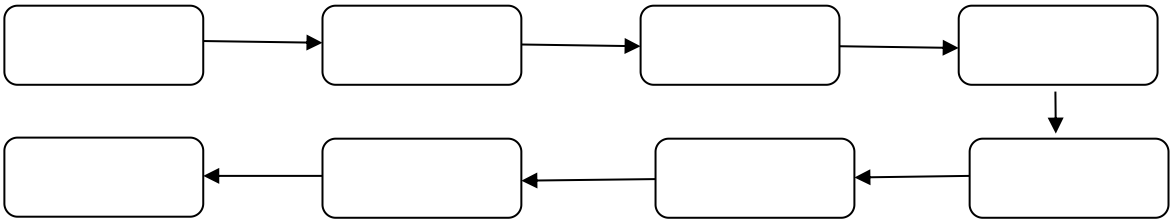
0					
	0°	22.5°	45°	67.5°	90°
	108	107.2	108.5	107	107
	114.7	114.5	114.5	114.8	114.5
min	533	533	533	534	533

max	535	535	535	535	535

2.1 G115

G115 1 000 1 060 950

6 SA-335P91 870



6 G115

2.2

G115 5

7

7 G115

2.3

G115 A

B A + B +

7 8 G115

7

			MPa	MPa	A	
A1	20	T/4	519	678	25.0	/
A2	20	T/2	529	682	25.0	/
B1	20	T/4	521	676	23.0	/
B2	20	T/2	497	668	21.5	/
A1	650	T/4	267	278	34.0	/
A2	650	T/2	260	280	38.0	/
B1	650	T/4	265	271	33.0	/
B2	650	T/2	262	281	37.0	/

8

	mm	10×10	KV2		
A1	20	T/4	130/73/116	/	/
A2	20	T/2	93/81/118	/	/
B1	20	T/4	118/111/86	/	/
B2	20	T/2	96/106/118	/	/

2.4

A B

+

+

1 G115

≥3

=

2 G115

G115

3 G115

G115

+

4 G115

630

55

供热抽汽改造方式及管道布置分析

300 MW

TM621 A 1001-9006 2022 03-0028-05

Analysis of Extraction Steam Heating Supply Retrofit Methods and Pipeline Layout

, , ,

Dongfang Electric(Chengdu) Engineering & Consulting Co.,Ltd., 611731, Chengdu, China

Abstract: In recent years, with the demand of heating and deep-peak regulation of thermal power units, qualified thermal power units have begun to carry out heating retrofit according to plant conditions, in order to improve the comprehensive utilization efficiency of energy and achieve the goal of energy conservation and emission reduction. At present, the heating retrofit of 300 MW and above capacity units in China mostly adopts the technology of drilling steam extraction heating retrofit and low-pressure cylinder cutting cylinder retrofit. This paper analyzes and discusses the similarities and differences between the above two kinds retrofit technologies and the layout of steam extraction pipeline, in order to provide reference for the subsequent projects.

Key words: heating retrofit; lower pressure cylinder zero output; extraction piping; expansion

2022-02-14

1983 2008

200 MW

300 MW

1 [7]

	200 MW	200 MW	300 MW	600 MW
MPa	0.3	0.245	0.85/0.5*	1.1
	270	245	335	360

*

[1-3]

[4]

600 MW

1.2

[5]

[6] (20 t/h)

300 MW

1.1

2 300 MW/600 MW

	300 MW	300 MW	660 MW
MPa	0.6	0.98	0.5
	296	350	350

2

D-GD2000

X

Y

2.3

1~2

2

cii[9]

3

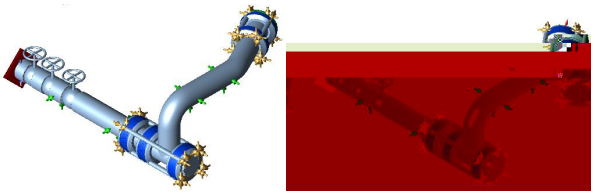
4

350 0.6 MPa(g),

0.1

2

SUS



2 600 MW

OPE 3

3

		/	1 GUIDE	2 GUIDE	3 GUIDE	4 GUIDE	5 ANC	
SUS	+	FX N	58	-180	15	5	-41 015	4
		FY N	0	-4	20	5	43 338	-8
		FZ N	-23 335	-73 505	-30 520	-73 715	-86 500	-15 732
		MX N.M	0	0	0	0	-36 635	-32 940
		MY N.M	0	0	0	0	81 640	-17 735
		MZ N.M	0	0	0	0	161 780	1
	+	FX N	-2 210	7 440	-502	-176	-45 512	-152
		FY N	0	-191	16	6	43 338	181
		FZ N	-54 385	-57 380	-28 880	-72 340	-85 960	-13 735
		MX N.M	0	0	0	0	-35 080	-36 565
		MY N.M	0	0	0	0	81 385	60 035
		MZ N.M	0	0	0	0	161 780	-1

		FX N	-4 935	27 925	3 125	7 385	-69 771	-4 835
		FY N	0	-11 430	-456	226	43 290	11 185
		FZ N	-10 295	-86 360	-30 775	-73 605	-86 525	-15 755
	+	MX N.M	0	0	0	0	-36 280	-67 000
		MY N.M	0	0	0	0	81 650	-75 810
		MZ N.M	0	0	0	0	161 765	-1 265
OPE		FX N	-951	23 380	2 920	7 220	-70 150	-3 558
		FY N	0	-4 618	-302	155	43 305	4 400
		FZ N	-65 240	-46 185	-29 185	-72 210	-85 990	-13 870
	+	MX N.M	0	0	0	0	-34 806	-45
		MY N.M	0	0	0	0	81 395	16 345
		MZ N.M	0	0	0	0	161 770	105

2

2

1 300~600 MW

2

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A Study of Air Pressing Energy Storage and Boiler Couple System

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Abstract: This article creatively proposes a coupling system of compressed air energy storage with power station boilers, which effectively solves the problem of low efficiency, it could help the grid to absorb the electricity fully generated by new energy sources and it can be used for peak shaving and valleys filling, and the grid runs more reliably.

Key words: compressed air; energy storage; compressed air energy storage (CAES); coupling

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