中国燃煤电站的低NOx燃烧和脱硝技术概况

The Overview of Low NOx Combustion and Denitrification Technology for Coal-Fired Power Plants in China

李 振 中

Mr. Zhenzhong, Li

国家“863”计划洁净煤主题

The Clean Coal Theme of the China’s High-Tech S & T Plan

国家电站燃烧工程技术研究中心

National Power Plant Combustion Engineering Research Center

2005-8-1

NPCC

Combustion Research

国家电站燃烧工程技术研究中心

主要内容
Content

一、中国煤电主要燃烧状况

Combustion condition of Coal-Fired Power Plants in China

二、开发、应用的低NOx燃烧和脱硝技术

Development and Application of Low NOx combustion and Denitrification Technology

三、建议中美双方合作的领域与方式

Field and Mode of Co-operation Proposed between China and U.S.

一、中国煤电主要燃烧状况
Combustion condition of Coal-Fired Power Plants in China

中国发电能源结构的预测（%）

Forecast of energy structure of China's power generation (%)

年份 Year	火电（主要是煤电）Thermal electricity (mainly coal –fired electricity)	水电 Hydro power	核电 Nuclear power	新能源 New energy
2000	77.8	21.0	0.9	0.3
2010	75.3	20.0	3.8	0.9
2020	70.6	21.5	6.1	1.8

一、中国煤电主要燃烧状况
Combustion condition of Coal-Fired Power Plants in China

我国电能占一次能源比重和煤电比重预测
Forecast of the electricity percent in primary energy

年 份 Year	1990	2000	2020	2030
电能占能源比重（%） Percent of electricity over the primery energy (%)	26	36	44	46
煤电机组占容量的比（%） Percent of coal power installed capacity over the total installed capacity (%)	72.0	77.9	70.0	60

一、中国煤电主要燃烧状况
Combustion condition of Coal-Fired Power Plants in China

1、中国电力的发展
Development of China's Power Industry

- **2004**年我国发电总装机容量为**440**GW
  China's total installed generating capacity is 440GW in 2004.
- 其中火电装机容量约为**350**GW
  The installed capacity of coal fired power plants is 350GW.
- 规划**2010**年末全国发电装机容量将达到**701GW**
  The total installed generating capacity will reach 701GW in 2010.
- 其中火电装机容量约为**480 GW**
  The installed capacity of coal fired generation will reach 480GW.
- 规划**2020**年全国发电装机容量达到**1060GW**
  The total installed generating capacity will reach 1060GW in 2020.
- 其中火电装机容量约为火电**623 GW**
  The installed capacity of coal fired generation will reach 623GW.

一、中国煤电主要燃烧状况
Combustion condition of Coal-Fired Power Plants in China

2、中国电力工业的NOx排放

NOx emission from China's electricityl industry

- 2000年电力工业NOx污染物排放358.02万吨

  3.5802 Mt in 2000

- 2002年电力工业NOx污染物排放520万吨

  520Mt in 2002

- 2010年电力工业污染物排放594.74 万吨

  5.9474 Mt in 2010

一、中国煤电主要燃烧状况
Combustion condition of Coal-Fired Power Plants in China

3、中国典型燃煤机组的NOx排放情况

The NOx emission from some typical coal-fired units

- **600MW及以上大型机组　380~450mg/Nm3（大部分设计为低NOx燃烧器）**

  380~450mg/Nm3 for 600MW and over units (most of them have been designed with LNBs)

  三菱、阿尔斯通、日立、B&W技术；哈锅、上锅、东锅等技术

  Technologies from Michishimi, Alstom, B & W, Harbin Boiler Plant, Shanghai Boiler Plant, Dongngfang Boiler Plant.

一、中国煤电主要燃烧状况
Combustion condition of Coal-Fired Power Plants in China

3、中国典型燃煤机组的NOx排放情况

The NOx emission from some typical coal-fired units

- **200MW ~ 300MW　650 ~ 1300mg/Nm^3（根据煤种、炉型不同，差别较大）**

  650 ~ 1300mg/Nm^3 for 200MW ~ 300MW units (larger difference of emission because of different coals and furnaces)

  哈锅、上锅、东锅等旋直流技术

  The direct and swirl flow technologies from Harbin Boiler Plant, Shanghai Boiler Plant, Dongngfang Boiler Plant.

- **100MW及以下小型机组　700~1800mg/Nm^3（根据煤种、炉型不同，差别较大）**

  700~1800mg/Nm^3 for 100MW and below units (larger difference of emission because of different coals and furnaces)

  哈锅、上锅、东锅等旋直流技术

  The direct and swirl flow technologies from Harbin Boiler Plant, Shanghai Boiler Plant, Dongngfang Boiler Plant

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

1、NOx控制技术研究开发情况
Research & Development of the NOx Control Technologies

- 低NOx燃烧器技术
  Low NOx Burners
- SOFA低氮燃烧技术
  Separate Over Fire Air(SOFA)
- 超细化煤粉再燃低NOx燃烧技术
  Reburning of Micronized Coal
- SCR烟气脱硝技术
  Selective Calalytic Reduction in Flue Gas
- 活性炭/焦脱硫脱硝技术
  De-NOx and De-SO_2 integration with activated carbon/coke

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

1、NOx控制技术研究开发情况

Research & Development of the NOx Control Technologies

- 电子束脱硫脱硝技术

  De-NOx and De-SO2 technology by electric beam

- 等离子体烟气脱硝技术

  plasma De-NOx in flue gas

- 尿素添加剂湿法烟气同时脱硫脱氮技术研究开发

  De-NOx and De-SO2 technology with urea additive in wet flue gas

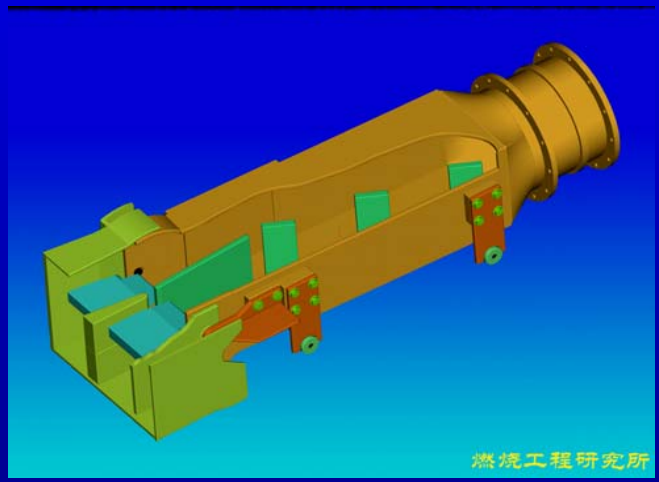
- 流光放电半湿法烟气同时脱硫脱氮技术及工程化

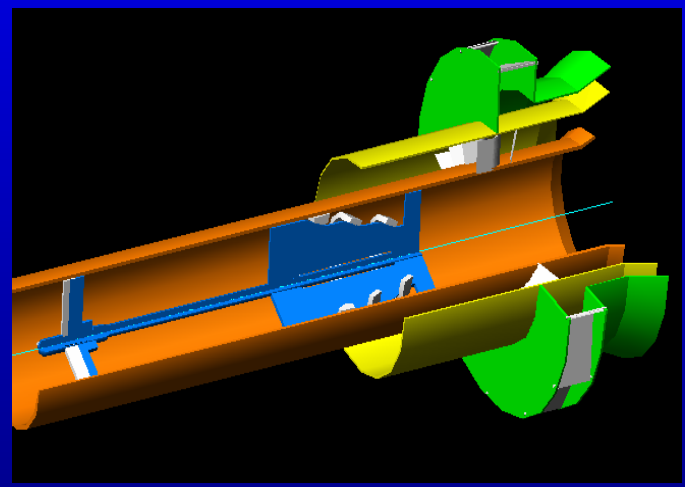
  De-NOx and De-SO2 technology with discharge in semi-wet flue gas

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

低NOx燃烧器技术
Low NOx Bueners(LNBs)

- 典型低NOx燃烧器结构
  Typical Structure of a LNB





二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

低NOx燃烧器技术

Low NOx Bueners(LNBs)

- 低NOx燃烧器技术指标

  Technical index

  NOx排放量300~600mg/m^3

  NOx emission: 300~600mg/m^3

  改造机组NOx减排＞30%

  NOx emission decrease of unit after retrofit : ＞30%

  具有防高温腐蚀性能

  Anti corrosion in high temperature

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

低NOx燃烧器技术

Low NOx Bueners(LNBs)

- 低NOx燃烧器技术应用

Application of LNBs Technology

60~600MW机组

60~600MW units

无烟煤、贫煤、烟煤、褐煤

Anthracite, lean coal, bituminous,brown coal

中速直吹制粉系统

Middle speed direct firing pulverized system

钢球中储制粉系统

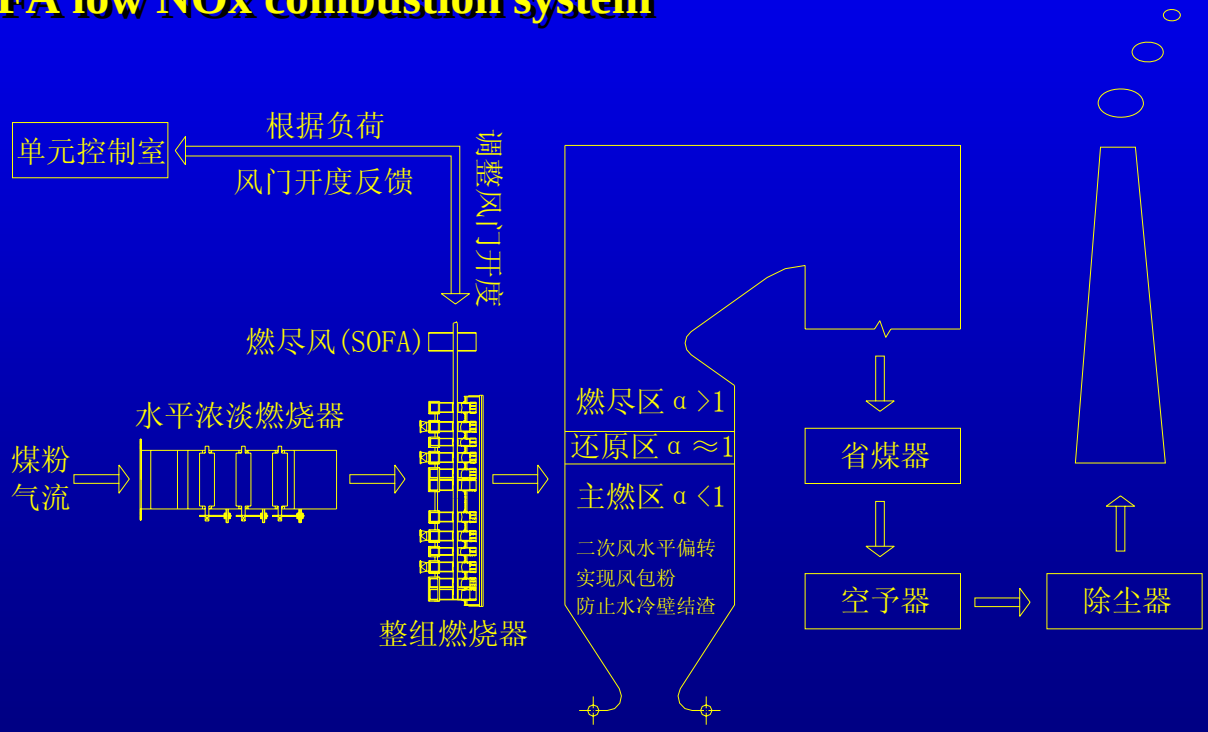
Ball bin storage pulverized system

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

SOFA低氮燃烧技术

SOFA Low NOx Combustion Technology

- SOFA低氮燃烧技术系统
  SOFA low NOx combustion system



二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

SOFA低氮燃烧技术
SOFA Low NOx Combustion Technology

- **SOFA低氮燃烧技术指标**
  Index of SOFA low NOx combustion technology

  NOx排放（烟气中折算含氧量为6%）
  NOx emission (O2 =6%in flue gas)
  燃用烟煤NOx＜380mg/Nm^3
  Bituminous:NOx＜380mg/Nm^3
  燃用褐煤NOx ＜350mg/Nm^3
  Brown coal: NOx ＜350mg/Nm^3
  锅炉效率影响＜ 0.8%
  Impact on boiler efficiency : NOx ＜350mg/Nm^3
  投资成本≤30元/千瓦
  Capital cost: ≤30yuan /kW
  节约环保收费成本50%
  Saving environmental charge: 50%

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

SOFA低氮燃烧技术

SOFA Low NOx Combustion Technology

- SOFA低氮燃烧技术应用

  Application of SOFA low NOx combustion technology

  200MW机组

  200MW unit

  烟煤

  Bituminous

  球磨中储制粉系统

  Ball bin storage fired pulverized system

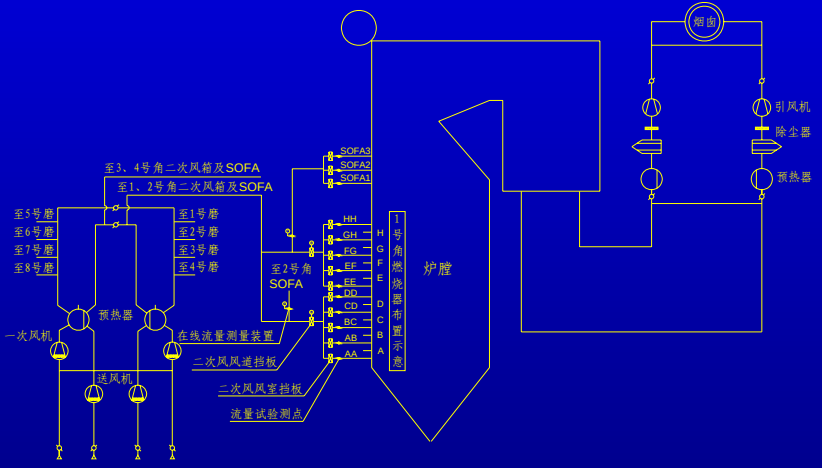
  直流燃烧器四角切圆燃烧系统

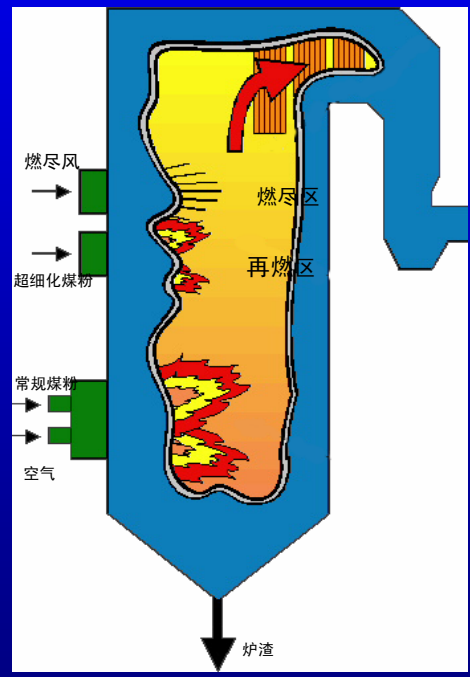
  Direct flow burner tangential combustion system

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

超细化煤粉再燃低NOx燃烧技术
Micronized coal reburning low NOx Combustion Technology

- 超细化煤粉再燃低NOx燃烧技术系统
  Micronized coal reburning low NOx ombustion system





二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

超细化煤粉再燃低NOx燃烧技术
Micronized coal reburning low NOx Combustion Technology

- 超细化煤粉再燃低NOx燃烧技术指标

Iindex of the micronized coal reburning low NOx ombustion technology

运行成本增加<0.015元/千瓦时

Operating cost: <0.015yuan /kWh

NOx排放（烟气中折算含氧量为6%）

NOx emissiom (O2 =6%in flue gas)

燃用烟煤NOx<300mg/Nm^3

Bituminous: NOx <300mg/Nm^3

燃用褐煤NOx<350mg/Nm^3

Brown coal: NOx<350mg/Nm^3

投资成本≤50元/千瓦

Investment cost ≤50元yuan /kW

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

超细化煤粉再燃低NOx燃烧技术
Micronized coal reburning low NOx Combustion Technology

- 超细化煤粉再燃低NOx燃烧技术应用

  Application of micronized coal reburning low NOx combustion technology

  600MW机组

  600MW unit

  褐煤和烟煤

  Brown coal and bituminous

  中速直吹制粉系统

  Middle speed direct firing pulverized system

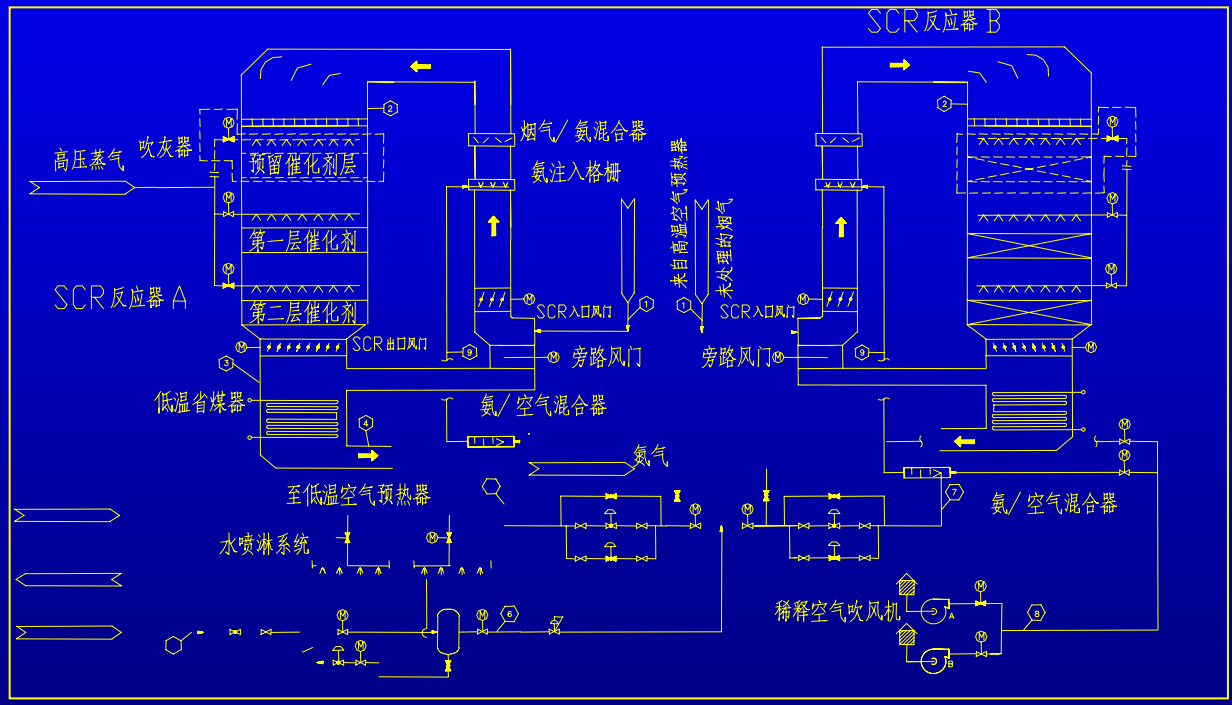
  直流燃烧器四角切圆燃烧系统

  Direct flow burner tangential combustion system

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

SCR烟气脱硝技术
Selective Calalytic Reduction in Flue Gas

- **SCR烟气脱硝技术系统**
  Selective Calalytic Reduction in Flue Gas Denitrification system



二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

SCR烟气脱硝技术
Selective Calalytic Reduction in Flue Gas

- SCR烟气脱硝技术指标

  Index of SCR flue gas denifrification

  NOx<50～100mg/Nm^3

  NOx<50～100mg/Nm^3

  SOx<100mg/Nm^3

  SOx<100mg/Nm^3

  粉尘浓度<30mg/Nm^3

  Concentration of particulate matter <30mg/Nm^3

  设备和材料国产化率>80%

  Domestic production of equipment and material >80%

  整机设备可用率>90%

  Availability of the whole equipment >90%

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

SCR烟气脱硝技术

Selective Calalytic Reduction in Flue Gas

- SCR烟气脱硝技术应用

Application of the SCR flue gas denifrification technology

100MW机组

100MW unit

烟煤和烟煤混煤

Blend of two kinds of bituminous

钢球中储制粉系统

Ball bin storage fired pulverized system

直流燃烧器四角切圆燃烧系统

Direct flow burner tangential combustion system

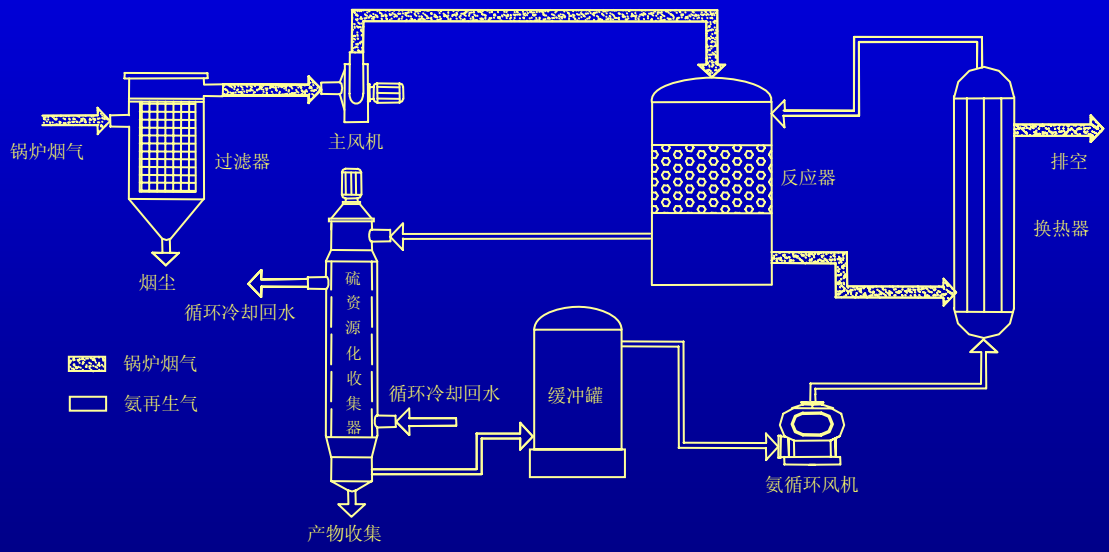
二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

活性炭/焦脱硫脱硝技术

De-NOx and De-SO_2 integration with activated carbon/coke Technology

- 活性炭/焦脱硫脱硝技术系统

De-NOx and De-SO_2 integration with activated carbon/coke system



二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

活性炭/焦脱硫脱硝技术
De-NOx and De-SO_2 integration with activated carbon/coke Technology

- 活性炭/焦脱硫脱硝技术指标
  Index of the De-NOx and De-SO2 integration with activated carbon/coke technology
  - 能够在同一温度区域，100~200℃，同时进行脱硫和脱硝
    Can simultaneously De-NOx and De-SO_2 integration with activated carbon/coke technology De-NOx and De-SO_2 at the same temperature range, 100~200℃
  - 脱硫效率＞96%
    Efficiency of desulfurization ＞96%
  - 脱硝效率在80%以上
    Efficiency of denitrification over 80%
  - 活性焦层的除尘作用可使排烟粉尘浓度＜10mg/Nm^3
    Concentration of particulate matter <10mg/Nm^3

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

活性炭/焦脱硫脱硝技术

De-NOx and De-SO_2 integration with activated carbon/coke Technology

- 活性炭/焦脱硫脱硝技术应用

  Application of De-NOx and De-SO2 integration with activated carbon/coke technology

  活性炭完成了中试

  Completed pilot-experiment with activated carbon

  活性焦应用到蒸发量2×75吨炉

  Applied in 2×75 t/h boilers

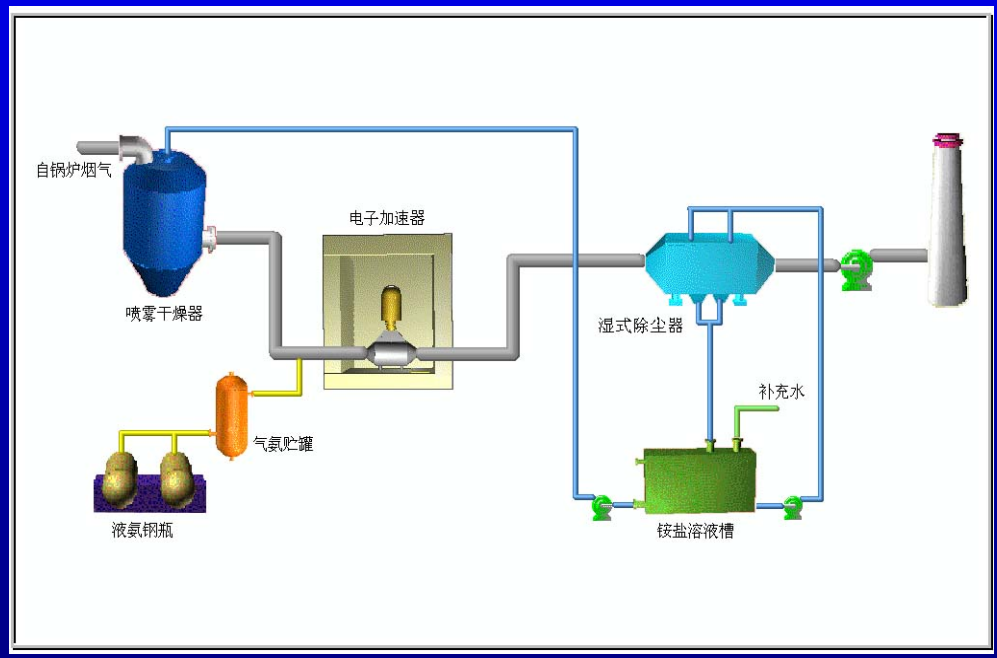
  烟煤

  Bituminous as fuel

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

电子束脱硫脱硝技术
De-NOx and De-SO_2 technology by electric beam

- 电子束脱硫脱硝技术系统
  System of a De-NOx and De-SO2 technology by electric beam



二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

电子束脱硫脱硝技术

De-NOx and De-SO_2 technology by electric beam

- 电子束脱硫脱硝技术指标

Index of electric beam technology

脱硝率＞30%

NOx reduction ＞30%

达到产业化后投资不高于600元/kW

Investment will be less than 600 yuan/kW after industrialization

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

电子束脱硫脱硝技术

De-NOx and De-SO_2 technology by electric beam

- 电子束脱硫脱硝技术应用

  Application of the electric beam technology

  2×25MW机组

  2×25MW unit

  烟煤

  Bituminous

  中速直吹制粉系统

  Middle speed direct firing pulverized system

  直流燃烧器四角切圆燃烧系统

  Direct flow burner tangential combustion system

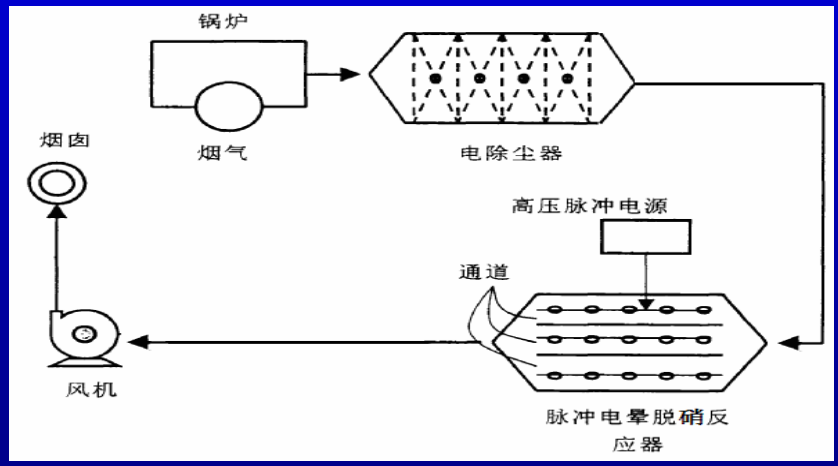
二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

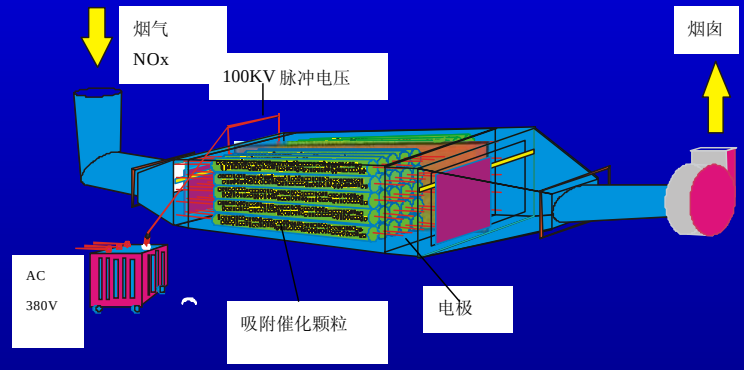
等离子体烟气脱硝技术

Plasma flue gas denitrification technology

- 等离子体烟气脱硝技术系统

System of plasma flue gas denitrification technology





二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

等离子体烟气脱硝技术

Plasma flue gas denitrification technology

- 等离子体烟气脱硝技术指标

  Index of the plasma flue gas denitrification

  烟气NOx脱除效率＞85%

  NOx Reduction ＞85%

  烟气NOx脱除能耗3.6＜kJ/Nm^3(1Wh/m^3)

  Energy consumation ＜ 3.6 kJ/Nm3(1Wh/m3)

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

等离子体烟气脱硝技术
Plasma flue gas denitrification technology

- 等离子体烟气脱硝技术应用

Application of Plazma flue gas denitrification

在50MW机组上建设50000Nm3/h装置试验

Test on a 50 unit with flue gas flow rate of 50000Nm^3/h

烟煤

Bituminous as fuel

中速磨直吹制粉系统

Middle speed direct firing pulverized system

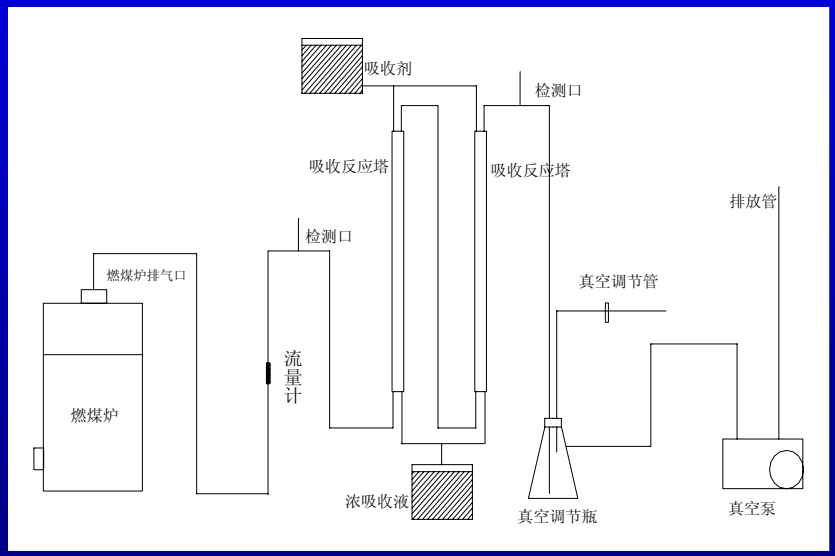
直流燃烧器四角切圆燃烧系统

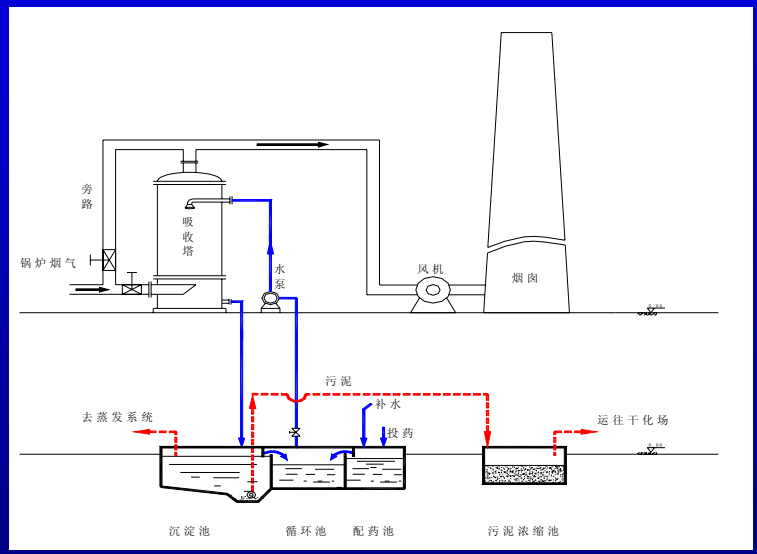
Direct flow burner tangential combustion system

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

尿素添加剂湿法烟气同时脱硫脱氮技术研究开发
R & D of De-NOx and De-SO_2 technology simultaneously with urea additive in wet flue gas

- 尿素添加剂湿法烟气同时脱硫脱氮技术研究开发系统
  System of R & D of De-NOx and De-SO_2 technology simultaneously with urea additive in wet flue gas





二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

尿素添加剂湿法烟气同时脱硫脱氮技术研究开发

R & D of De-NOx and De-SO_2 technology simultaneously with urea additive in wet flue gas

- 尿素添加剂湿法烟气同时脱硫脱氮技术研究开发指标

  Index of urea additive in wet gas technology

  SO_2的脱除率达到90%以上

  SO_2decrease is over 90%

  NOx的脱除率达到80%以上

  NOx reduction is higher than 80%

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

尿素添加剂湿法烟气同时脱硫脱氮技术研究开发

R & D of De-NOx and De-SO2 technology simultaneously with urea additive in wet flue gas

- 尿素添加剂湿法烟气同时脱硫脱氮技术研究开发应用

  Application of the urea additive in wet flue gas technology

  建设了中型试验装置蒸发量为2~10吨/时锅炉

  Has built a pilot-test boiler with steam production 2~10t/h

  应用于蒸发量为35吨/时锅炉

  Applied in a boiler with steam production 35t/h

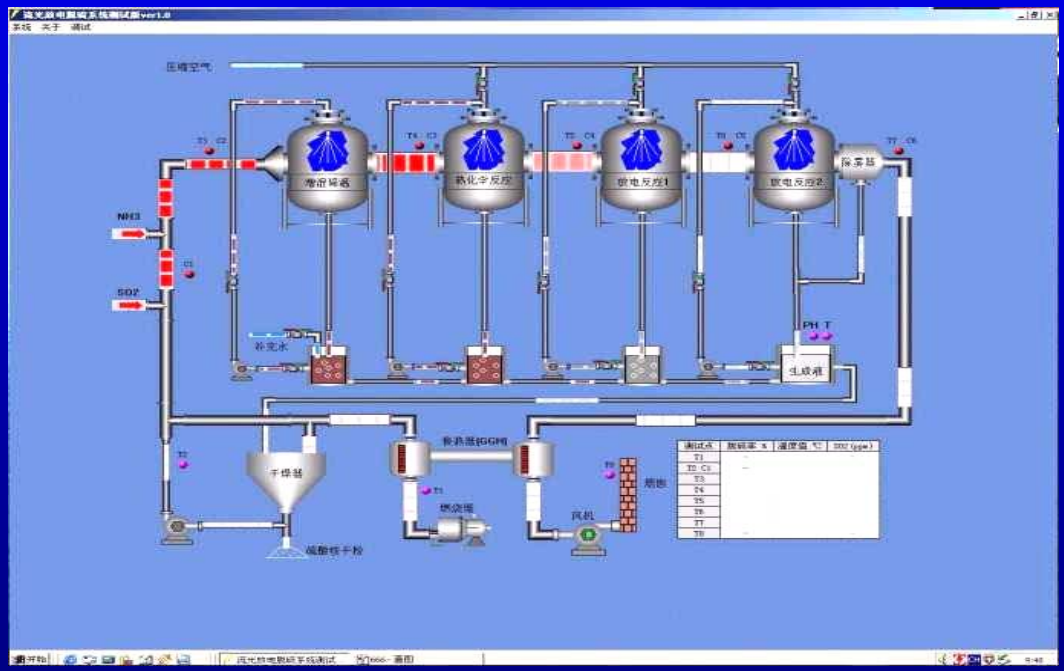
  烟煤或烟煤混煤

  Fuel: bituminous or blend of bituminous

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

流光放电半湿法烟气同时脱硫脱氮技术及工程化
Streamer discharge semi-wet flue gas De-SO2 and De-NOx simultaneously and its engineering

- 流光放电半湿法烟气同时脱硫脱氮技术及工程化系统
  System of streamer discharge in semi-wet flue gas technology



二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

流光放电半湿法烟气同时脱硫脱氮技术及工程化
Streamer discharge semi-wet flue gas De-SO2 and De-NOx simultaneously and its engineering

- 流光放电半湿法烟气同时脱硫脱氮技术及工程化指标

  Index of the streamer discharge semi-wet flue gas engineering

  示范装置脱硫效率≥95%

  Desulfurization efficiency in demo. facility ≥95%

  脱硝效率≥40%

  Denitrification efficiency ≥40%

  单台AC/DC电源功率125kVA，电压峰值50kV，交流频率10-20kHz

  Power supply of a single AC/DC set 125 125kVA , peak volt.50kV, frequency 10~20Hz

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

流光放电半湿法烟气同时脱硫脱氮技术及工程化

Streamer discharge semi-wet flue gas De-SO2 and De-NOx simultaneously and its engineering

- 流光放电半湿法烟气同时脱硫脱氮技术及工程化指标

  Index of the streamer discharge semi-wet flue gas engineering

  系统投资≤450元/kW

  Investment ≤450yuan/kW

  脱硫费用≤1000元/吨

  Cost for desulfurization ≤1000yuan/t

  等离子体能耗≤1.8Wh/m^3

  Energy of plasma ≤1.8Wh/m^3

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

流光放电半湿法烟气同时脱硫脱氮技术及工程化
Streamer discharge semi-wet flue gas De-SO2 and De-NOx simultaneously and its engineering

- 流光放电半湿法烟气同时脱硫脱氮技术及工程化应用
  Application of the treamer discharge semi-wet flue gas De-SO_2 and De-NOx simultaneously

  蒸发量为65吨/时锅炉

  Boiler with 65t/h evaporative capacity

  处理烟气量为260000m^3/h

  Flue gas flow rate 260000m3/h

  炉型和煤种不限

  Any kinds of boiler and coal can use

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

2、中国燃煤电站脱硝工程及采用的技术

De-NOx Engineering and Adoptable Technology in China's Coal-Fired Power Plant

- 已建烟气脱硝装置

Flue gas denitrification facility has built built:

漳州后石电厂　4X300MW　中鼎 & 日立　SCR

Houshi Plant in Zhangzhou 4X300MW　zhongding & Hitachi　SCR

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

2、中国燃煤电站脱硝工程及采用的技术

De-NOx Engineering and Adoptable Technology in China's Coal-Fired Power Plant

- 在建烟气脱硝装置

Flue gas denitrification facilities are being built:

江苏徐州阚山发电厂 600MW X 2 NPCC & 美国FTI SCR/SNCR

Kanshan plant in jiangsu 2 X 600MW NPCC & FTI(U.S.) SCR/SNCR

浙江宁海电厂 600MW X 1 浙大能源 & 日立 SCR

NingHai plant in Zhejiang 1 X 600MW UZJ Energy & Hitachi SCR

广东台山电厂 600MW X 1 浙大能源 & Topsoe SCR

Taishan plant in Guangdong 1 X 600MW USJ Energy & Topsoe SCR

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

2、中国燃煤电站脱硝工程及采用的技术

De-NOx Engineering and Adoptable Technology in China's Coal-Fired Power Plant

- 在建烟气脱硝装置

Flue gas denitrification facilities are being built:

厦门嵩屿电厂 300MW X 4 上海电气集团&日本IHI SCR

Songyu plant in Xiamen 4 X 300MW Shanhai Elect. Group & IHI SCR

江苏太仓电厂 600MW X 1 江苏苏源环保 & 日立 SCR

Taicang plant in Jiangsu 1 X 600MW Jiangsu Suyuan & Hitachi SCR

广东恒运发电厂 200MW X 1 东锅 & 鲁奇 SCR

Hengyun plant in Guangdong 1 X 200MW Dongfang Boiler plant & Lugi SCR

二、开发、应用的低NOx燃烧和脱硝技术
Development and Application of Low NOx and Denitrification Technology

2、我国燃煤电站脱硝工程及采用的技术

De-NOx Engineering and Adoptable Technology in China's Coal-Fired Plants

- 近期拟建烟气脱硝装置

Flue gas denitrification facilities will be built in near future

国华 • 北京第一热电厂　100MW X 4

Guohua •Beijing No.1 heat & power plant 4 × 100MW

大唐 • 北京高井发电厂　100MW X 4 + 50MW X 4

Datang • Beijing Gaojin plant 4 × 100MW + 4 × 50MW

大唐 • 浙江乌沙山发电厂 600MW X 1

Datang • Zhejiang Wusashan 1 X 600MW

三、建议中美双方合作的领域与方式
Field and Mode of Co-operation Proposed between China and U.S.

1、合作技术类型及范围
Co-operative Technologies and Their Scopes

- SCR、SNCR、SCR/SNCR系统成套技术、关键工艺和关键设备

  Sets of Technology , the key process and equipment of SCR, SNCR, SCR/SNCR systems
- 针对旧机组改造的低NOx技术

  The Low NOx Technology focused on the old unit retrofit
- 针对新建机组的非烟煤煤种的低NOx技术

  The Low NOx Technology focused on the new unit with non-bituminous as fuel
- 引进催化剂的生产技术、工艺

  The production process of imported catalysts
- 更先进的新的脱硝技术

  The more advanced De-NOx technology

三、建议中美双方合作的领域与方式
Field and Mode of Co-operation Proposed between China and U.S.

2、合作方式

Co-operative mode

- 国外技术的基础上，共同进一步开发

  Jointly develop on the basis of technology outside China

- 技术转让、技术支持（项目合作）

  Technology alienation and support for project cooperation

- 共同建立在中国的合资公司

  To set up the jointly owned company in China

三、建议中美双方合作的领域与方式
Field and Mode of Co-operation Proposed between China and U.S.

3、国外公司和中国企业的合作情况

Co-operative circumstance of enterprises between China and the overseas

日本IHI	&	上海电气集团公司	SCR
Jipan IHI	&	Shanghai Electric Group Co.	SCR
日本MHI	&	哈尔滨锅炉厂	SCR
Jipan IHI	&	Harbin Boiler Plant	SCR
德国鲁奇(LEE)	&	东方锅炉厂	SCR
Germany Lugi	&	Dongfang Boiler Plant	SCR
日本日立	&	江苏苏源环保公司	SCR
Japan Hitachi	&	Jiangshu Shuyuan Envir.	SCR

三、建议中美双方合作的领域与方式
Field and Mode of Co-operation Proposed between China and U.S.

3、国外公司和中国企业的合作情况

Co-operative circumstance of enterprises between China and the overseas

日本JEE(NKK)	&	常州三立环保设备工程公司	SCR
Japan JEE(NKK)	&	Changzhou Sanli Envir. Co.	SCR
美国Fuel Tech	&	辽宁科林环保工程公司	SNCR/SCR
U.S. Fuel Tech	&	Liaoning Clean Envir. Co.	SCR/SNCR
德国KWH	&	东方锅炉厂	催化剂
Germany KWH	&	Dongfang Boiler Plant	Catalyst

三、建议中美双方合作的领域与方式
Field and Mode of Co-operation Proposed between China and U.S.

4、中美合作的切入点

The contact point of China-U.S. co-operation

- 以实现工程项目为切入点，以合资（技术合作）企业为载体

  The engineering project to be implemented as the contact point

  The jointly owned enterprise (or tech. Co-operation) as the carrier

- 单一技术和多种技术

  Single technology and multi-technology

- 新机组新建与旧机组改造

  New unit build and old unit retrofit

- 低NOx燃烧技术与烟气脱硝技术

  Low NOx Combustion and Flue gas denitrification

致　　谢

Thank You