Dry FGD Technology Research and Application in Steel Sintering

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Abstract: Based on wet and dry flue desulfurization technology (FGD), and after digesting the import of technology, we developed LJS-steel sintered two-stage reaction of sintering flue gas pollutants removal process. this process is successful applied in Fujian SanMing 180 m^2 sintering machine, desulfurization efficiency more than 93%, while total removal of SO_3, HCl, HF acidic gases. The project obviously improve the atmospheric environment around steel plants.

Keywords: Sintering flue gas, Dry FGD, Two-stage reaction

1 INTRODUCTION

Fujian SanGang Mingguan Co., LTD. located in down-town of SanMing city. The environment bureau of Fujian province which supervises the environment quality of this district forces the company to install flue gas desulfurization in a 180 m^2 volume new sintering. As we know, there is less little designers and engineers practice of FGD for sintering all around the world, especially, in China. The tender spent over year on investigating different FGD technologies.

After analyzing the feasible of many types of dry and wet FGD, SanGang company firstly excluded the wet FGD. They summarize several disadvantages of wet FGD in their project:

1) They should spent a lot of money in doing anti-erosion work, especially, for their sintering gas. Even they install gas-gas heat (GGH), they should install anti-erosion layer for stack. This part will also increase the capital cost.

2) Consuming a great volume of water, and they should have a dealing waste water system.

3) Needing much more first capital cost and energy consuming. High maintenance and operation cost will be spent.

4) The stack is less high and will release waste gas. People around the company will misunderstand them.

5) There is not concrete plant or wall-plaster plant around the company. So there is one problem of utilization of byproduct of FGD.

Finally, SanGang company turned to dry flue gas technology. They gathered different process of dry FGD around China and visit their project one by one. In the last time, they hoped that the Longking which do very well in dry FGD for power plant can develop one technology for their sintering FGD. So Longking Research and Development Department engineers developed LJS two-stage dry FGD processing for multi-pollutant control, after analyzing the different situation of sintering and power plant. In this processing, it has these characterizes as follows:

1) Longking have not any project in the former time in sintering plant. However, they set up several dozens of dry FGD for power plant including 300 MW boilers. In designing these projects, we make a lot of progresses for some special parts. Because Longking is the big manufacture company which has the ability to design and manufacture the special FGD equipment for different situation plant. De-dust (ESP\ FF), dry lime hydrator, pneumatic convey system all can be design according to FGD situation.

2) Using the CaO of SanGang and hydrating them in FGD island.

3) In SanGang Company FGD project, they have the pre-collect system for ash. we use baghouse for de-dust after dry FGD, the ash release level is lower than 50 mg/Nm^3.

4) In the LJS two-stage dry FGD consuming less water and energy. No waste water to be dealt.

5) High removal of acid gas such as SO_3, HCl, HF etc. There is no necessary anti-erosion for stack.

6) Especially, SanGang company found that they will produce some Dibenzo-p-Dioxin (TyssenKrupp AG Company reported that the sintering produce 20 percent of total Dibenzo-p-Dioxin in European).In our processing ,we add activated carbon after the baghouse system to reduce Dibenzo-p-Dioxin.

In January, 2007, Longking finally signed the contract with SanGang Company. SanGang Company checked up the design and began to install in June, 2007. Finally, worker begin to operate LSJ two-stage dry FGD for desulfurizing flue gas.

1.1 Mechanism and Process Flow Diagram

A typical LJS two-stage dry FGD include absorbent prepare system, absorbent inject system, absorber system, recycle material system, process water system, de-dust after FGD system and instrument and device control system. We can see this process flow diagram as follows (Fig. 1).

Sintering gas pass the pre-collection system into the ID Fan .Then the gas release into the environment by bypass or LJS two-stage dry FGD. In LJS two-stage process, gas enter into the LJS absorber at the bottom of the system; absorbent (lime or quicklime), sorbent (Can be chosen for VOC, Heavy mental, or Dibenzo-p-Dioxin), recycle ash are all injected into the high temperature of Venture. These material mixing with gas pass through venture and form circulation fluid bed at the top of the venture. The relative of velocity of particles and gas makes the surface of reaction more fresh and increase exchange of energy and mass between gas-solid. SO_x, HCl,

HF are easily removed. In order to supply a best situation for reaction, water is injected at the top of venture.

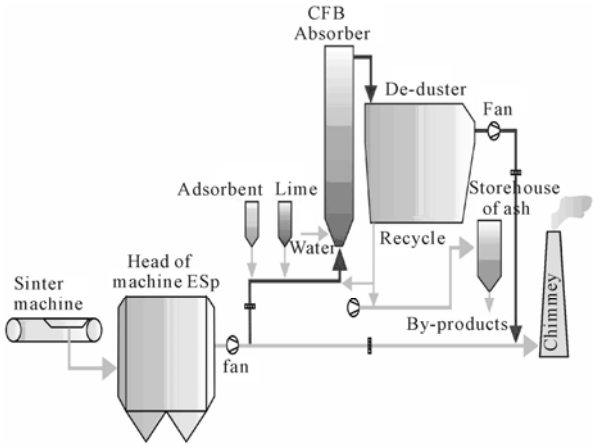

Fig. 1 Process Flow Diagram of LJS Two-stage dry FGD

After the reaction in the absorber, flue gas is exhausted for the top absorber and enter into the de-dust system, clear gas pass ID fan after de-dust system. Most collected dust is recycled into the absorber, only small part of them is convey into byproduct silo.

The chemical reaction of FGD as follows:

$Ca(OH)_2+SO_2=CaSO_3•1/2\ H_2O+1/2H_2O$;

$Ca(OH)_2+SO_3=CaSO_4•1/2H_2O+1/2H_2O$;

$CaSO_3•1/2H_2O+1/2O_2=CaSO_4•1/2H_2O$;

$Ca(OH)_2+CO_2=CaCO_3+H_2O$;

$2Ca(OH)_2+2HCl=CaCl_2•Ca(OH)_2•2H_2O$ (□120 □);

$Ca(OH)_2+2HF=CaF_2+2H_2O$.

1.2 Mainly Technology Data

The LJS two-stage dry FGD for SanGang company include a bypass system, the mainly technology data as follows:

1) the basic information of sintering:

sintering volume: 180 m^3;

ID Fan: 7500 m^3/min;

Annual operation time: 7500 h.

2) FGD system design data:

Gas flow rate (half desulfurization): 430000 m^3/h;

Inlet SO_2 concentration:3000 mg/Nm^3–5000 mg/Nm^3;

Inlet temperature :140–180 □, max.240 □;

SO_2 removal efficiency : ≥93%;

SO_2 Emission concentration≤400 mg/Nm^3;

Emission temperature:75 □;

Dust emission concentration:≤50 mg/Nm^3.

1.3 Layout of System

The whole system lay out between the main road and form ball factory after the stack. The absorber, baghouse system and ID fan are lay out alone a line. Absorber, lime and quick lime silo are lay out on the surface of concrete platform which stride on the main road. The surface of platform is 7 meters above the surface of main road and bottom of platform is 5.5 meters above it. The pillars between each other under the platform is 8 meters. The space leaves for factory main road standard. The baghouse after FGD lay out transversely and have the same platform as FGD absorber. The fluid fan and other process equipments lay out under the space of the baghouse platform. The ID fan lay out other surface of earth. Control room, process water system and other equipments are fixed on the surface of platform. All equipments lay out optimizedly in order to fit the limited space. We can see Fig. 2.

Fig. 2 SanGang 180 m^2 Dry FGD System

2 OPERATION CONDITION

180 m^2 sintering plant with dry FGD at Sanming Steel Plant has passed trial operation at full load for 240 hours successfully. Fig. 3 is the DCS picture.

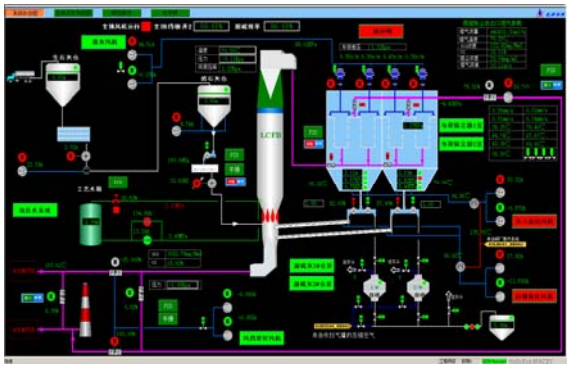

Fig. 3 DCS of 180 m^2 sintering plant with dry FGD at Sanming Steel Plant

1) Main operation parameter:

Gas flow rate: 430000 m^3/h–460000 m^3/h;

Desulfurization efficiency: ≥93%, the highest efficiency reaches 99%;

Flue gas temperature at the outlet: 73 □–76 □;

Emission of SO2: 30 mg/Nm^3–380 mg/Nm^3;

Emission of dust: –30mg/Nm3.

2) Power and materials consumption:

Power consumption: 1056 kW (including FGD system and ID fan);

Water consumption: 19 t/h (including water for hydration);
Lime consumption: 1.4 t/h.

3) Investment and operation cost:

Total investment: 30 million RMB;

Operation cost: 625 RMB/t SO_2 (not including depreciation).

3 CONCLUSIONS

Thanks to the research and successful application of LJS two-stage dry FGD, the concentration of SO_2 in original flue gases (5000 mg/m^3) in Sanming Steel Plant decreases to less than 400 mg/m^3, even less than 100 mg/m^3, thus it reduces the pollution to the environment. The operation of this item shows that, the technology is muture and economic and it also marks that Sanming Steel Plant has taked a first firming step for SO_2 emission reduction in sintering plant.

REFERENCES

1. Jiang Rongcai, et al. Selection on FGD Scheme for SanMing Steel №2 Sintering Plant. Agglomeration, 2007 (4), 18-21.
2.]Lin Chunyuan. Design and Application of CFB-FGD System at Large-scale Power Plant. Energy and Environment, 2005 (2): 43-46.
3. Yi, J., Sauer, H., Leuschke, F., Baege, R. What is possible to achieve on flue gas cleaning using the CFB technology? The 8th International Conference on CFB, Hangzhou, Chian, May 10-13, 2005.
4. Leuschke, F., Baege, R., Yi Jianglin, Lin Chunyuan. The future of CFB-FGD in China. The 2nd China International $DeSO_x$ $DeNO_x$ Exhibition &Conference, Beijing, China, Sept. 6-8, 2006.