Removal Characteristics of Iron Particles by Ceramic Candle Filters and the Effect of the flue Gas Inlet Configuration in Particulate Collectors

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Traditional de-dusting systems in new steel making industry are a wet scrubber system including the slurry treatment system in addition to the particulate removal facility[1]. The iron slurry, as a by-product of the process, can be further processed to reach the dry status after which it can be pressed in compact iron briquettes for recycling purpose. In addition the high temperature flue gas through the system can decrease the flue gas temperature.

In order to eliminate the iron slurry from the system a dry type iron particulate removal system allows high particulate removal efficiency with no additional downstream facility for slurry treatment. High temperature and high pressure iron particulate laden flue gas treatment is done by applying ceramic candle filters which can remove particle load with high efficiency and can endure extreme operating conditions. Removal of collected particles from the outer surface of ceramic filters is done by high pressure air injection the candles with high pressurized air, driven in counter flow to flue gas stream. Based on the dust load the ceramic candle filters are pulsed frequently. Due to accumulated dust on the outer surface, the pressure drop increases consequently until pressure drop of filter cleaning start is reached. In order to reduce the dust load facing the ceramic candle filter, a new concept of centrifugal separator was introduced at the lower part of the collector. This configuration of the inlet duct was compared with the traditional direct inlet. The combination of cyclone and bag filters was studied in the reference[2-3]. In their study the authors reported a significant decrease of dust load inside the lower part of separator prior to reaching the filter bags. We expect that the dust load will reduce and the pulsing of the ceramic filter candles will be less frequent thus extending the life span of ceramic filters.

Table 1. Experimental conditions

Test filter: Silicon-carbide ceramic filter		
Filtration area,	m^2	0.294
Filtration velocity,	m/min	0.5 ~ 1.0
Inlet dust concentration,	g/m^3	20.0
Pulse-jet air pressure,	kg_f/cm^2	5.0
Pulse duration,	msec	100
Pulsing DP,	mmH_2O	250

Test set-up consists of the following operational units: heaters, ceramic filter chamber with lower part, dust hopper, dust feeder, air pulsing unit, flow controller, compressor unit, data acquisition unit, particle concentration measurement device and control panel. Dust feeder was operating under high pressure and at controlled feeding rates. Pulsing of the filter candle was initiated automatically after the pressure drop (DP) has reached the setting terminal pressure drop value (250 mmH_2O). Data of the residual pressure drop and the pressure drop evolution were collected automatically using data acquisition unit. Particle concentration was measured at the inlet and outlet of the filter chamber and the particle collection efficiency calculated.

The results show that when the unit is operated with the cyclone part the pulsing interval was increased. The increase of pulsing interval was proven to be dependent on the filtration velocity. The higher the velocity the greater was the difference between two configurations of the inlet duct. Also we could observe a significant decrease of residual pressure drop when the unit was operated with the cyclone part installed, as shown in Figure 1.

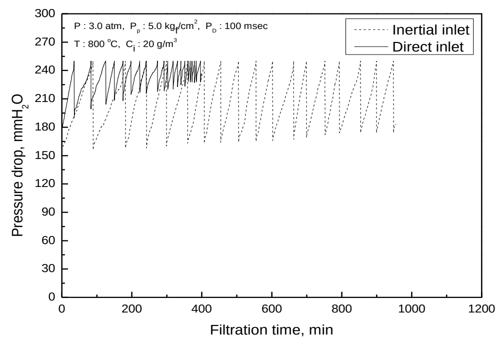

Figure 1. Comparison between two inlet duct configurations and the impact on the pressure drop.

The effect of the presence of cyclone part on the iron particle removal efficiency was observed. For the configuration with cyclone part, the overall collection efficiency increased above the value 99.99% for filtration velocities 0.5, 0.8 and 1.0 m/min.

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