Effect of Dust Concentration on Filter Cleaning in a Pulse-jet Bag Filter

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Keywords: Bag filter, Cleaning, Pulse jet, Pressure drop, Dust concentration
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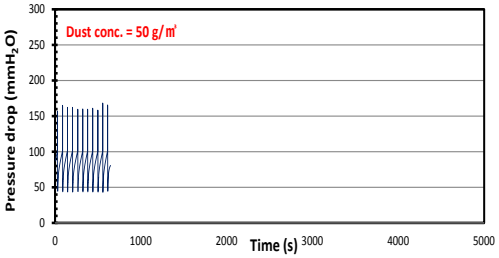
Bag filter dust collectors are commonly used in industry for removing fine solid particles form dust-laden gases. During filtration, the gases pass through the filter media forming particle deposits, called dust cake, on the surface of filter. The cake causes a linear increase in pressure drop across the filter. Thus, the dust cake must be removed, and filter bags have to be frequently regenerated by pulse-jet cleaning. Intrinsically bag filters are clogging and cleaning (regeneration) cycles during operation of the dust collectors. The cycles of filter system should be going smoothly for the un-interrupted process operation. Therefore, understanding many factors, such as dust concentration and filtration velocity, is very important for cleaning effectiveness.

In this study we investigated the effect of dust concentration on bag filter pulse-jet cleaning and dust emission in a single-chambered jet pulsed bag filter. The filter of 3m long in 156 mm diameter was used for the test. 40A blow tube having a 10mm hole was positioned above the bag. Fly ash from coal fired power plant was used as test dust and inlet concentration was varied from 50 g/m^3 to 5 g/m^3 at 3.0 m/min filtration velocity and air pressures for filter cleaning were regulated as 5, 4 and 3 kg$_f$/cm^2. Dust emission was measured by an optical particle counter (GRIMM 1109) in the exhaust duct of bag filter test unit, and filter cleaning performance was monitored by measuring pressure drops. Filter cleaning was triggered when the pressure drop of bag filter reached 100mmH$_2$O.

Figure 1 shows the results of filter bag cleaning at 5kg$_f$/cm^2 of pulsing air pressure in case of 50, 20 and 5 g/m^3 dust concentrations. Figure 2 exhibits the results of dust emission measurement for same condition. For the stable and longer cleaning interval, lower dust concentration was more effective, indicating higher inlet concentration would be hazardous to the cleaning effectiveness. In addition, the higher cleaning air pressure led to increasing dust emission, even though the bag filter was kept clean.

This work was supported by the National Research Council of Science & Technology (NST) grant by the Korea government (MSIP) (No. CRC-15-07-KIER).



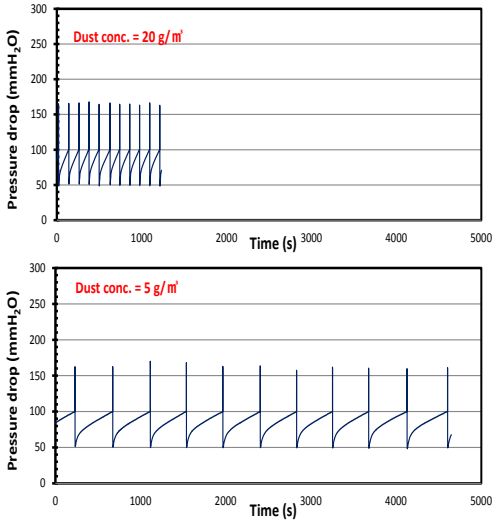


Figure 1. Filter cleaning result at 50 g/m^3(upper), 20 g/m^3(middle) and 5 g/m^3(lower) of inlet dust concentration and 5 kg$_f$/cm^2 cleaning air pressure.

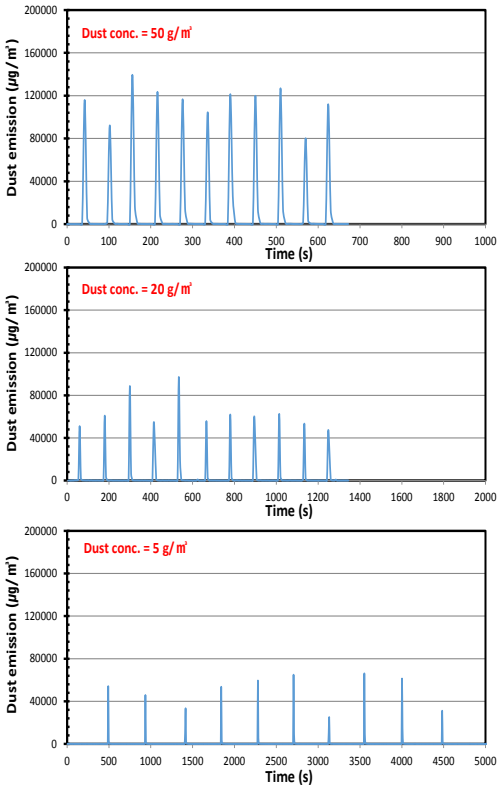


Figure 2. Dust emission at 50 g/m^3(upper), 20 g/m^3(middle) and 5 g/m^3(lower) of inlet dust concentration