Title: The Influence of unburned carbon on the filtration performance of a ceramic filter

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Submit by: March 15, 2001

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Summary

For the continuous operation of filter, the filter element is periodically cleaned by the pulse cleaning, in which the dust cake of the transition layer is detached. So the internal tensile strength of dust cake is more important than that between dust and filter element in order to predict the required force for cleaning. Several factors can be responsible for causing particles to stick together. These include the electrostatic force, van der Waals forces, and chemical interaction at high temperature. The relative strength of these forces is depended mainly on the particle size distribution, particle shape, particle composition, gas composition, and temperature. However, the co-dependency of these many factors makes it difficult to understand the filtration phenomenon systematically. Moreover, there are a few experimental data measured under the realistic condition for application in the commercial plant and to estimate the performance trend according to the particulate properties. The primary focus of this study is to measure the effects of unburned-carbon which has the different particle shape form the general fly ash. So, we compared the filtration properties of a ceramic filter for the fly ashes from conventional power plant (PC ash) and from fluidized bed combustion (FBC ash) at a hot bench unit using a commercial filter element. The PC ash has the spherical particles mainly because they are melted at high temperature above 1300^{o}C during the coal combustion and contains less unburned carbon. Otherwise, FBC ash contains much unburned carbon and has irregular particles because the combustion temperature is low below 900^{o}C. The mean average particle size of the two ashes used in this study was similar with the value of about 15μm And FBC ash has relatively high composition of unburned carbon and irregular particle.

The six elements of commercial SiC filter candle, Vitropore ^{TM} (form Refractron Techn., US) were mounted in a hot bench filter unit. The rate of pressure drop through the dust cake and the pressure drop rate through the residual dust layer after pulse clean were carefully measured at high temperature of 500 ^{o}C. The dust cake of FBC shows the lower value of the pressure drop rate through dust cake as well as the pressure drop rate through the residual dust cake. This results conclude that the random shape of particle forms dust cake of high porosity and enable to the filter element be cleaned easily by the pulse cleaning

Acknowledgements: The authors appreciate the financial support of Korea Energy Management Corporation R&D Management Center for Energy and Resources.