Mercury Behavior in Flue Gas Control System with Sorbent

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Toxic metals that are very harmful to health are also included in the coal combustion flue gases and on ash particles that are discharged to the atmosphere. The mercury release behavior in bituminous coals, and the partitioning rate of mercury in solids and gaseous in flue gases have already measured. The rate of mercury partitioned into bottom ash in a bench-scale pulverized coal combustion furnace was a little and that into cyclone ash was low below 10%. The rest of the mercury was partitioned into mercury in gaseous form, but the rate partitioned into dust, oxidized mercury and elemental mercury varied slightly depending on the flue gas temperature and the type of coal. Therefore, in this study, the rate and behavior of the oxidized mercury and the elemental mercury were measured in the condition of adding sorbent as well as different coal ashes. The kind of tested sorbent to capture the mercury were sixteen which were injected to make a thin bed on the filter. Experiments were carried out by using a small fixed bed of sorbent with mercury gas of 260 to 290$\mu g/m^3$ to examine the performance of mercury capture around 350 K and a flue gas duct of a bench-scale pulverized coal combustion furnace of 42 mm ID and 1150 mm high to confirm the performance to coal combustion gases around 450 K. In both experimental systems, a continuous mercury monitoring equipment was used. The concentrations of oxidized mercury and elemental mercury in gas and the total mercury in solid consisting of the sorbent and the coal ash were measured.

Consequently, activated carbon, fluidized bed combustion ash, wasted catalyst and sorbents including sulfur or chlorine compound were effective to capture the mercury. However, the results by evaluating the partitioning of mercury in gas between oxidized mercury and elemental mercury, showed that the element mercury captured by the sorbent once was changed into the oxidized mercury though it depended on the kind of sorbent and the gas condition. The capturing rate of oxidized mecury was signifcantly lower than that of elemental mecury. It means that there is a trade-off relationship between oxidized mercury and elemental mercury. Furthermore, to improve the performance of capturing mecury, it was very important to control the sorbent layer produced by filtering the fly ash and sorbent particulate.