X-ray analysis of Fouling from CFBC

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In order to flexibly respond to the social demand for technologies preventing global warming and climate change, environment-friendly way of producing energy and electric power is the most important issue in these days. To satisfy this demands, low-grade renewable energy resources treating the waste in an environmentally friendly way is encouraged as new forms of fuel technology. SRF(solid refused fuel), Bio-SRF(wood based biomass), low grade coals and composite fuels for low grade coals with SRF or Bio-SRF are good candidates to produce energy using sustainable and diverse resources.

CFBC (Circulating Fluidized Bed Combustor) is known as the most efficient technology in terms of high heat recovery rate, high-quality steam production, fast combustion rate and stability of operation. It is very important to increase the combustion efficiency of the CFBC used SRF as raw material, which is mainly decided from the boiler lifetime from stable operation and boiler efficiency from heat transfer efficiency of convection heat transfer part during operation.

Especially, the ash residue(fouling, clinker etc.) formed by fusion of the low melting point salt on the convection heat transfer part, which contains various alkali metals and chlorine in the solid fuel, is one of the most important problems to lower the combustion efficiency. Therefore, it is necessary to understand the factors that have a major influence on the formation of clinker in order to develop a technology to prevent the generation of clinker to enhance the boiler efficiency.

In this study, we investigated composition, phase of each spot after actual operation of CFBC boiler under different operating conditions using XRD phase identification, XRF semi-quantitative analysis, and line scan composition profile at the interface of tube and fouling using SEM-EDS quantitative analysis to understand formation behavior of fouling and clinker.

As a result, it was confirmed that clinker formation has significant correlation with operating condition. The temperature dependence on chemical composition and crystalline phase of ash residues shows thermodynamic approach could explain the main phenomena for fouling and clinker formation. This results shows possibility of thermodynamic approach to identify the phenomena in CFBC clinker and fouling formation behavior and improving the combustion efficiency in CFBC operation.