Investigation of Deposit Formation and its Characterization for a Pulverized Bituminous Coal Power Plant

SELAHATTIN BABAT, JÖRG MAIER, PROF. GÜNTER SCHEFFKNECHT

Institute of Combustion and Power Plant Technology Stuttgart, Germany

ABSTRACT

Fouling and slagging depend upon the boiler and firing system design, operational parameters and fuel properties. Release of inorganic compounds during combustion and their transformation into critical gaseous species, aerosols and ash particles may substantially affect the boiler efficiency and availability, due to the formation of fireside deposits.

The composition of the mineral matter in three bituminous coals and the associated initial layer deposits formed at the inlet of the superheater level in a 730 MWth pulverized fuel boiler are discussed in this paper.

A cooled probe (temperature-controlled) was used to obtain the initial layer de-posit samples, which were analyzed in detail by SEM-EDX. In all analyzed areas, spherical (formerly molten) iron-rich particles, likely derived from pyrite were observed. The particles found on the cooled probe were categorized in three particles classes and several particles in the different classes were analyzed by SEM-EDX to obtain their chemical composition.

Based on these analyses, thermochemical equilibrium calculations were performed using the FactSage simulation software to calculate the melting behavior of the particle classes found on the probe. In particular, the effect of reducing and oxidizing flue gas on the melting behavior of the three classes was investigated.

The results in this work indicate that the deposition of an ash particle is strongly influenced by the particle's history. Besides its composition, particularly the temperature and the atmosphere that a particle passes through have a significant influence on the melt formation and the probability of adhesion of the particle on a tube surface.