Deposit Probe Measurements in Large Biomass-Fired Grate Boilers and Pulverized-Fuel Boilers

A number of full-scale deposit probe measuring campaigns conducted in grate-fired and suspension-fired boilers, fired with biomass, have been reviewed and compared. The influence of operational parameters on the chemistry of ash and deposits, on deposit build-up rates, and on shedding behavior has been examined. The firing technology and the fuel utilized influence the fly ash and deposit chemical composition. In grate-firing, K, Cl, and S are enriched in the fly ash compared to the fuel ash, while the fly ash in suspension-firing is relatively similar to the fuel ash. The chemical composition of the deposits formed is determined by the fly ash composition and the flue gas temperature; increases in the local flue gas temperature lead to higher contents of Si and Ca and lower contents of Cl in the deposits. The net deposit build-up rates in grate-fired and suspension-fired boilers are at similar levels, 0–100 g/m²·h, while the ash deposit propensity is an order of magnitude larger in grate fired boilers than in suspension-fired boilers. Deposit build-up rates were found to increase at flue gas temperatures close to the melting temperatures of the fly ash. Furthermore, the rate of deposit build-up increased with the K-content of the fuel ash and fly ash for grate-fired boilers. For suspension-fired boilers, deposition rates are comparatively low for wood-firing and increase with increasing fuel straw shares. Shedding of deposits occurs by melting during straw-firing on a grate at high flue gas temperatures (>900 °C). At lower flue gas temperatures, the deposits can be removed by soot blowing. The required soot blower impact pressure is strongly influenced by the surface temperature, such that a high surface temperature makes the deposit more difficult to remove. During straw/wood-firing in suspension-fired boilers, shedding occurred by debonding with incomplete removal at flue gas temperatures of 600–1000 °C and by debonding with complete removal during wood-firing in suspension-fired boilers at high flue gas temperatures (1300 °C). Shedding events were not observed during wood suspension-firing at low flue gas temperatures.
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