

Ash particles from biomass residue: Mechanistic understanding of biomass ash adhesion at high temperatures

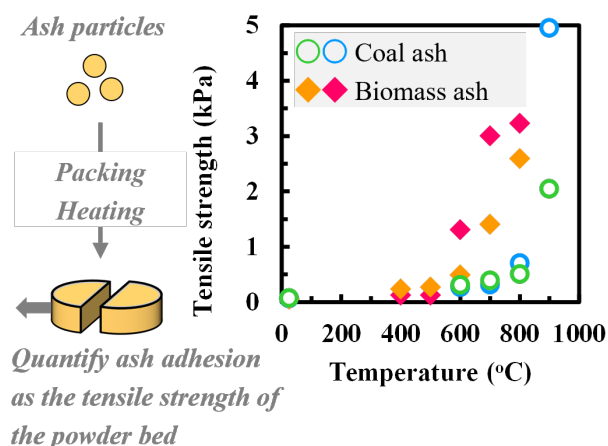
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In considering the use of biomass, it is necessary to pay attention to the treatment of biomass residue. Thermochemical treatment of residues is a common method of waste disposal. Because residues contain inorganic compounds, combustion produces ash particles. It is known that these ash particles cause operational problems in commercial plants due to their high adhesion at high temperatures (500–1000°C). To ensure efficient and stable residue treatment and support biomass utilization, it is necessary to evaluate and control ash particles at high temperatures. Herein, insights into the mechanistic understanding of ash adhesion are reported based on a unique method for quantifying particle adhesion at high temperatures. The ash adhesion was quantified as the tensile strength of the ash powder bed. Results from adhesion tests demonstrated that the tensile strength of biomass (sewage sludge) ash started to increase at lower temperatures than that of coal ash, suggesting the potential for serious ash adhesion problems in biomass combustion. To investigate the impact of ash chemical characteristics on particle adhesion, synthetic ash–model compounds representing ash generated in commercial plants—was designed and effectively used. Based on insights from synthetic ash study, the remarkable adhesion properties of biomass ash were discussed.

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Tensile strength of ash powder bed with coal and biomass (sewage sludge) ashes, plotted as a function of temperatures.