Studying the melting behavior of coal, biomass, and coal/biomass ash using viscosity and heated stage XRD data - DTU Orbit (06/12/2018)

The use of biomass for power generation can result in significant economical and environmental benefits. The greenhouse emissions can be reduced as well as the cost of the produced electricity. However, ash-related problems, including slagging, agglomeration, and corrosion, can cause frequent unscheduled shutdowns, decreasing the availability and increasing the cost of the produced power. In addition, the fouling of the heat exchange surfaces reduces the system efficiency. In this work the melting and rheological properties of various biomass and biomass/coal ash samples were studied by using a high-temperature rotational viscometer and a hot stage XRD. The produced data were used to calculate the operating temperature of a pilot-scale entrained flow reactor during the cocombustion of biomass/coal samples in order to ensure the slag flow and to avoid corrosion of the walls due to liquid slag/metal interaction. Biomass ash proved to have significantly different melting behavior compared to that of the coal ash. Furthermore, the addition of biomass to coal ash led to lower viscosity and subsequently to higher stickiness of the produced ash particles. The melting behavior of the slag generated by the cocombustion tests appeared to be somewhat different compared to that of the laboratory-prepared ash samples. The heated stage XRD data provide useful information regarding the reactions among the various ash compounds and the phase transformations during the heating and cooling of the ash samples and helped the explanation of the produced viscosity curves.

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