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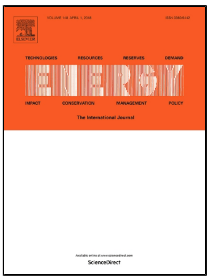

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Experimental and Modelling Studies on Condensation of Inorganic Species during Cooling of Product Gas from Pressurized Biomass Fluidized Bed Gasification

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ABSTRACT

In a biomass gasification process, condensation of inorganic species can cause problems such as corrosion and deposition on the downstream equipment. In this work, in order to investigate the condensation of inorganics during the gas cooling step of the biomass gasification system, both experimental and modelling studies were conducted. Experiments were performed on a pilot-scale steam/oxygen blown fluidized bed gasification facility. A CO_2 cooled probe was located at the head of a filter to condense inorganic species. Five thermocouples were used to monitor the probe temperature profile. Deposits on the probe were characterized using scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM/EDS) to analyze the elemental composition of deposits. A process model based on the local chemical and phase equilibriums was developed using software SimuSage to predict both release and condensation of inorganics. A customized thermodynamic database extracted from the FactSage 7.1 was used during model calculations. Two cases including with and without addition of bed material were calculated. Results show that the identified elemental compositions of deposit under different gas cooling temperatures reasonably agree with the elemental compositions predicted by model calculations. This demonstrates that the established model and the customized thermodynamic data are valid. A large amount of carbon is identified in the deposit of low temperature probe sections, which may come from the condensed tar. Additionally, a temperature window is found, where melts are formed during gas cooling.

Keywords: biomass, inorganics, condensation, gasification

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