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Hao Zhou, Weichen Ma

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An experimental study on the effects of adding biomass ashes on ash sintering behavior of Zhundong coal

Hao Zhou*, Weichen Ma

State Key Laboratory of Clean Energy Utilization, Institute for Thermal Power Engineering,

Zhejiang University, Hangzhou, Zhejiang 310027, People's Republic of China

ABSTRACT: This study investigated the effects of adding biomass ashes on the sintering behavior of ash from Zhundong coal (ZD) in a horizontal-chamber furnace. The ashes were prepared from corn stalk pellets (CS), rice hull (RH), and wood pellets (WP). The operating temperature was set as 1 573 K. A charge-coupled device (CCD) camera was used for online evaluation of the morphological changes of ash samples during the sintering process. A range of analytical techniques were applied to the sintered ash samples including scanning electron microscopy (SEM), energy-dispersive X-ray spectrometry (EDX), and X-ray diffraction (XRD). Base-to-acid ratio analysis and chemical equilibrium calculation were conducted to reveal the influence of adding biomass ashes on the fusion characteristics of ZD ash. Results showed that CS and RH ashes promoted sintering behavior of the ZD coal ash, whereas, WP ash inhibited it. The smallest shrinkage in height of the ash block is 0.55 for the RH 10% blend, and the smallest area is 0.45 for the CS 10% blend. Higher blend ratio reduced the positive effects on sintering behavior of ash blends. XRD analysis revealed the interaction between coal and biomass ashes, and showed that alkali metals and calcium play significant roles during the sintering process. Base-to-acid ratio analysis and chemical equilibrium calculation agreed with the experimental results.

* Corresponding Author: Hao ZHOU, PhD.

Tel: +86-571-87952598; Fax: +86-571-87951616;

E-mail address: zhouhao@zju.edu.cn

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