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Application of Biomass Pellets for Iron Ore Sintering

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Abstract. The use of biomass as fuel might solve several technological and environmental issues and overcome certain challenges of sinter production. In particular, as revealed by comprehensive analyses, biomass can be used as fuel for iron ore sintering. In this study, we investigate the use of some raw and pyrolysis-processed biomass pellet types, namely wood, sunflower husks (SFH), and straw, for iron ore sintering. In the experiments, the pyrolysis temperature was set to 673, 873, 1073, and 1273 K, and the proportion of biomass in the fuel composition was set to 25%. It was established that the addition of biofuels to the sintering blend leads to an increase in the gas permeability of the sintered layer. The analysis of the complex characteristics of the sintering process and the sinter strength showed the high potential of wood and sunflower husk pellets pyrolyzed at 1073 and 873 K, respectively, for iron ore sintering. The analysis of the macrostructure of the sinter samples obtained using biomaterials revealed that with higher pyrolysis temperatures; the materials tend to have greater sizes and higher amounts of pores and cracks. The composition analyses of the resultant sinters revealed that with higher temperature, the FeO content of the sinters tends to increase.

Introduction

In metallurgy, it is essential to obtain and use high-quality fuel and reducing agents with low environmental impact. It is also essential to integrate environmentally friendly technological processes to comply with the Kyoto Protocol [1]. It is known that iron ore sintering is the most environmentally harmful process among all the metallurgical processes. Moreover, the application of environmentally friendly fuels is becoming more beneficial owing to the increasing cost of conventional carbon fuels, such as coke and anthracite.

Biomass possesses the advantages of renewable source of energy, CO_2 neutrality, low ash content, and almost complete absence of sulphur. However, biomass has the disadvantage of low bulk density, volatile matter, high moisture and oxygen content, presence of alkaline earth metals, relatively low carbon content, and, as a consequence, relatively low heat value.

Biomass and its products have shown promising potential as fuel and reducing agents, respectively. Several review papers [2-8] have comprehensively considered the prospects, achievements, and challenges of biomass utilisation, especially in the metallurgical industry. The effective way to use biomass in metallurgy is by the iron ore sintering process.

Ooi et al. [9] studied the sintering process with fuel containing different amounts of sunflower husk and coke. The fuel blends were made using coke and sunflower husk based on the calorific value of 5% coke breeze. The results showed that the replacement of 10% of coke with sunflower husk did not significantly change the characteristics of the sintering process and the sinter quality, but contributed to the decrease in the formation of 2,3,7,8-PCDD/Fs by approximately 10% (from 1 to 0.91 ng/Nm^3). In the case of replacing 20% of coke with charcoal, the emissions of dioxins decreased by approximately 33%.

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