PYROLYSIS OF LIGNIN TO CREATE A NEW FOUNDRY FUEL SOURCE

Nicole R. Brown, Curtis Frantz, Matthew S. Lumadue, Fred S. Cannon, Sridhar Komarneni

The Pennsylvania State University
226 Agricultural and Biological Engineering
University Park, Pennsylvania, USA

nrb10@psu.edu

Traditionally, coke has been the standard cupola foundry fuel source. Coke consists of a very strong and porous matrix containing a low amount of volatile chemicals. The coking process consumes about 20% of the energy efficiency of the fuel, and is a highly polluting process. We have produced a coke substitute made from industrial wastes including anthracite fines (a stockpiled residue) and lignin. The "briquette" produced has the necessary porosity and mechanically withstands the extreme conditions of the cupola furnace, acting as a suitable substitute for coke.

In this presentation, chemical characterization of the briquettes will be discussed, primarily relating to the evolution of lignin chemistry under high temperature pyrolyzing conditions. GC-MS and ^{13}C CP-MAS NMR spectroscopy show the rapid disappearance of oxygen-containing functionalities and the transformation from ambient lignin to a fused poly-aromatic structure. Homolysis of the C-O bonds between the methoxyl oxygen atoms and the aromatic carbon at approximately 400°C serves as the initiation of this conversion. This homolysis likely leads to radical coupling, and eventually the formation of the polyaromatic char. The strength of the briquettes will also be discussed.