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Computer Modeling of Iron Ore Pelletizing Thermal Processing in Grate Kiln Furnaces

Iron Ore mined from the northern Minnesota iron range account for most of the United States total iron ore pellet production. In the industry there are many opportunities to recycle lost energy to produce a more efficient process. Computer modeling could help by reducing the need to run more full scale trials that are expensive. It would give insight on key areas to improve and optimal setups.

Iron ore processing consists of three main steps, mining refining, and pelletizing and shipping of the concentrated iron ore as uniform pellets. My research looked at the thermal processing of the iron ore pellets. The properties of the pellets are critical for shipping and the final destination of the blast furnaces. The three main parts of thermal processing were drying firing and cooling. Drying removes the moisture from the pellets before it is fired. The firing starts the oxidation reaction to harden the pellets. The cooling removes the excess heat of the oxidation reaction and recycles air to use in the drying and firing.

To model this process, we used Chemcad and its Excel data mapping features. We used Chemcad to find all of the gas phase properties and handle all of the gas phase reactions. When then used excel and its VBA capabilities to find pressure drops, model the solid phase reactions, and run the mass balance. The set up for Chemcad can be seen in the Figure 1 and the set up for excel can be seen in Figure 2. This set up was for the overall goal of finding parameters for energy reduction and air pollution minimization.

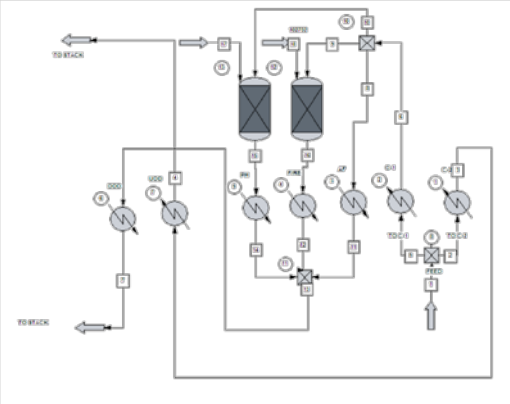

Figure 1

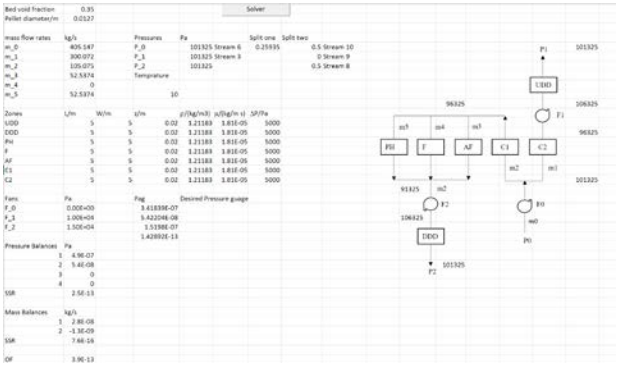

Figure 2

Currently we have successful used Chemcad and excel together in an advanced mineral processing environment and have the pressure and mass balances converging. Looking forward we will include all the solid phase reactions in the process, develop a user interface and use the model for optimization.