Sinter analogues mineralogy by different heating conditions

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ABSTRACT

Productivity and fuel consumption of the blast furnace is driven by the quality of the iron ore sinter, which in turn is related to the sinter mineralogy. The sintering conditions including temperature and gas composition have a significant influence on the formation of melt and finally the mineralogy of the sinter. In this work, analogue sinter tablets were produced from iron ore fines in a laboratory furnace with tightly controlled temperature profile and oxygen partial pressure in the gas. The mineralogy of the sinters was analysed using reflected light microscopy.

In the first series of experiments, the mineralogy of the analogue sinter tablets was analysed for a range of maximum temperature, holding time and cooling rate using the same iron ore type. Porosity of the calcined tablets was obtained using mercury intrusion porosimetry. In the second series, mineralogy and melt formation were studied under the same furnace operating conditions using different iron ores, with a range of goethite and alumina contents.

The results showed that increasing enclosed area (area enclosed by heating and cooling curve above a reference temperature) reduces primary hematite and platy silico-ferrite of calcium and aluminium (SFCA) contents. This is attributed to increasing melt formation, leading to greater assimilation of the iron ore particles. Lower magnetite was found for tablets with greater median pore size, which is through to be due to greater oxidation of magnetite to hematite during cooling in air.

Tablets with higher alumina content were found to result in more SFCA formation under the same heating/cooling conditions, whereas tablets with higher goethite had higher assimilation and produced more secondary hematite on cooling.

Finally, it is necessary to relate the enclosed area to the temperature at which the melt formation becomes significant which strongly depends on chemical compositions of the ore studied.