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Pellet porosity changes under simulated blast furnace shaft conditions

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A blast furnace (BF) is still the dominant process for making iron in the world. The blast furnace is charged with coke and iron burden materials including iron ore pellets, sinter and lump ore. While descending in the blast furnace the iron burden reduces. In order to simulate this, two different types of gas-temperature programs have been used. Program (1) has step-wise changes with gas composition consisting of CO, CO2, H2 and N2 whereas in experimental program (2) the changes in gas consisting of CO, CO2, and N2 occur smoothly. Both of these experimental programs are dynamic, and they are developed keeping blast furnace shaft conditions in mind.
In this work two different types of blast furnace pellets were predisposed to the two different gas-temperature programs mentioned earlier. These tests were done for single pellets with a built-in high-temperature thermogravimetric analyzer (TGA). The interest of this work lies in looking at the changes in pellet porosity during reduction. This is done measuring the skeletal volume of the pellet using a Micromeritics Accupyc II 1340 gas displacement pycnometer and combining this with the envelope volume attained by manual pellet diameter measurement in nine directions using a digital slide gauge. Since the interest lies in the pellet porosity, which needs to be measured before softening and melting, the chosen maximum temperature used was 1100 ℃. It was found out that the porosity of pellet A increased in both experimental programs. The increase was higher (127%) when program (1) was used compared to the pellet subjected to program (2) where the increase was milder (53%). The same trend could be seen in pellet B as well even though pellet B had higher increases in porosities, f. ex. program (2) increase was 102% compared to the grade A increase of 53%.

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