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Influence of the Moisture Content on the Flowability of Fine-Grained Iron Ore Concentrate

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Abstract : The iron content of the ore used is crucial for the productivity and coke consumption rate in blast furnace pig iron production. Therefore, most iron ore deposits are processed in beneficiation plants to increase the iron content and remove impurities. In several comminution stages, the particle size of the ore is reduced to ensure that the iron oxides are physically liberated from the gangue. Subsequently, physical separation processes are applied to concentrate the iron ore. The fine-grained ore concentrates produced need to be transported, stored, and processed. For smooth operation of these processes, the flow properties of the material are crucial. The flowability of powders depends on several properties of the material: grain size, grain size distribution, grain shape, and moisture content of the material. The flowability of powders can be measured using ring shear testers. In this study, the influence of the moisture content on the flowability for the Krivoy Rog magnetite iron ore concentrate was investigated. Dry iron ore concentrate was mixed with varying amounts of water to produce samples with a moisture content in the range of 0.2 to 12.2%. The flowability of the samples was investigated using a Schulze ring shear tester. At all measured values of the normal stress (1.0 kPa – 20 kPa), the flowability decreased significantly from dry ore to a moisture content of approximately 3-5%. At higher moisture contents, the flowability was nearly constant, while at the maximum moisture content the flowability improved for high values of the normal stress only. The results also showed an improving flowability with increasing consolidation stress for all moisture content levels investigated. The wall friction angle of the dust with carbon steel (S235JR), and an ultra-high molecule low-pressure polyethylene (Robalon) was also investigated. The wall friction angle increased significantly from dry ore to a moisture content of approximately 3%. For higher moisture content levels, the wall friction angles were nearly constant. Generally, the wall friction angle was approximately 4° lower at the higher wall normal stress.

Keywords : iron ore concentrate, flowability, moisture content, wall friction angle
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