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Iron Ore Pellet Dustiness Part I: Factors Affecting Dust Generation

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Abstract

The mineral processing industry is trending towards the zero-waste approach, which includes minimizing particulate matter emissions. One concern includes the shipping and handling of high-tonnage products, such as iron ore pellets. Pellets fracture and abrade during handling, and produce fine particulates (such as PM_{10}) that can become airborne, often far away from the point-of-manufacture or pelletizing plant. Factors affecting pellet dustiness can range from inputs to agglomeration, to induration conditions, to the type and extent of handling – all may interact to some degree to affect final pellet structure and properties and ultimately dust production. Industrial and laboratory pellet samples prepared under a wide range of pelletizing conditions were collected. Major variables represented in the samples included bed depth; pellet chemistry; firing temperature; coke breeze addition; and two different chemistries with “good” and “bad” abrasion indices (as designated by the pellet supplier). Direct measurements of airborne particle mass produced by pellet handling were measured using MTU’s dust tower. The cumulative mass of particles collected during each trial was 10-100 mg/kg-drop, or 50-500 mg/kg over five drops through the tower. Significant differences in total dust collected were observed between different chemistry samples, and the firing temperature samples. Total airborne particle mass decreased from 587 to 124 mg/kg when firing temperature increased from 1050 to 1280 °C. No significant differences were observed in any of the PM_{10} measurements made during the trials. Correlation between cumulative airborne mass and abrasion indices (R^2=0.69) may primarily be due to effects of under-firing pellets. Weakly bonded pellets easily abrade, contributing to the formation of potential dust particles. Considering only well-fired pellets (AI < 5 % -0.5 mm) led to a correlation coefficient of 0.22. Observations made during this study led to the development of a new method to study iron ore pellet dustiness.