CHoPS 2022
10th International Conference on Conveying and Handling of Particulate Solids
Salerno (Italy), 5-9 July 2022

Solid State Material Driven Turbine to Reduce Segregation Effects in Bunkers

Michael Denzel[1], Michael Prenner[1]

[1]Chair of Mining Engineering and Mineral Economics – Conveying Technology and Design Methods, University of Leoben, Leoben, Austria

Keywords: segregation, bunker filling, energy recovery, particle breakage, blast furnace sinter

ABSTRACT

For most applications and following processes an evenly distributed bunker outflow is desired in terms of particle size. Various discrete element simulations were performed to analyze the current state of an existing bunker used for storage of blast furnace sinter, which is simply filled with a discharging belt conveyor. Great segregation effects could be determined, which are mainly caused by the filling method and further intensified by the core flow effect and bunker geometry effects.

Several concepts and devices to reduce segregation in bunkers were evaluated using DEM. Therefore, the particle size distributions at the bunker outflow were each compared with the current state without device. A solid state material driven turbine is presented, which reduces segregation effects during bunker filling and leads to a significant improvement while discharging. The results show a more evenly distributed bunker outflow in terms of particle size.

As sinter is a very abrasive material, the wear at the turbine has also been evaluated. Furthermore, the power output in this case and the potential of energy recovery were investigated, which could be of interest in many other applications.

Additionally, the particle degradation at the solid state material driven turbine is evaluated in this case. Therefore, a newly developed breakage model for DEM is used. The model is based on the particle replacement method, combined with the voronoi tessellation algorithm and replacement probabilities to achieve a high accuracy in terms of fragment size distribution. The fragments are further breakable, which also allows simulation of more complex conveying systems. The breakage model is calibrated with a specially developed single particle impact tester, which allows rapid analysis of breakage characteristics of bulk materials.

Correspondence to: Michael Denzel, PhD Student
Chair of Mining Engineering and Mineral Economics
Conveying Technology and Design Methods
University of Leoben
Franz-Josef-Straße 18, 8700 Leoben, Austria
E-Mail: michael.denzel@unileoben.ac.at