CUSTOMER STORY

# MADE OF STEEL

## ARCELORMITTAL OPTIMIZED SINTER COOLER CHARGING SYSTEM USING ALTAIR® EDEM™

**About the Customer**

ArcelorMittal is the world's leading steel and mining company, with a presence in 60 countries and primary steelmaking facilities in 17 countries employing more than 190,000 people. In a recent project, a large-scale charging chute of a sinter cooler plant in Fos-Sur-Mer had to be optimized by the ArcelorMittal R&D team to improve the reliability and efficiency of this device. The objective was to identify a better and more feasible design that improved granular segregation, abrasion, and mechanical resistance. The team used Altair® EDEM™, a software based on the discrete element method (DEM), to gain a better understanding about the overall material behavior and the sinter cooling charging system.

> "EDEM enabled us to understand the material behavior and the charging system – and consequently, find an optimal design to improve sinter cooling efficiency."
>
> Edouard Izard, Research and Development, ArcelorMittal

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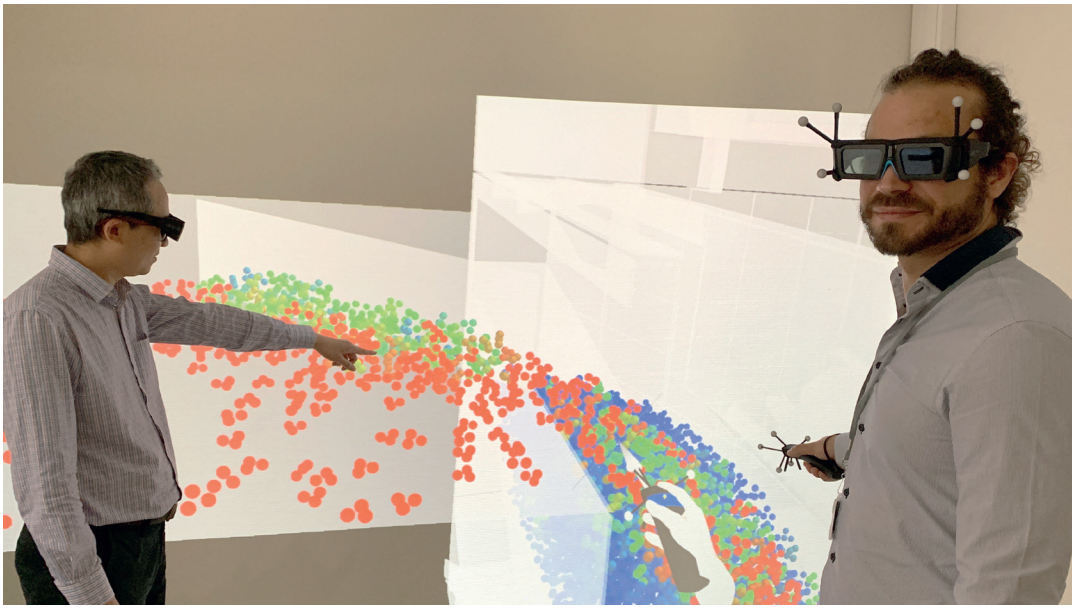

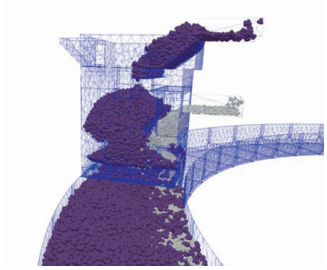

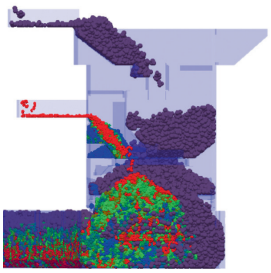

**LEFT:** DEM simulation of a sinter cooler charging chute system – Edouard Izard (right) **TOP:** The DEM simulation provided valuable insight into the granular flow in the charging chute and segregation patterns. **BOTTOM:** Using the DEM model of the charging system the team was able to study the effect of the filling ratio on granular flow patterns. (Images: ©ArcelorMittal)

## Their Challenge

To get a processible particle size, fine iron ores are agglomerated, fired on the sinter strand, and cooled down in the sinter-cooler before being crushed and sent to the blast furnace. During the charging of the hot material into the sinter cooler, particle segregation can occur, leading to several severe problems such as fire issues on conveyor belts and sinter quality issues. To investigate the segregation patterns, and in particular the impact of particle sizes and the effect of the filing ratio on the segregation patterns in the trolleys of the sinter strand, the R&D team had to find a suitable simulation method in order to analyze and optimize the particle flow. Since simulating granular flows in a large system compared to the particle size is complex and time-consuming, the R&D team had to set up a modelling strategy that allowed for a good balance between computational efficiency and physical realism.

## Our Solution

ArcelorMittal R&D used the high-performance software for granular material simulation EDEM to simulate and analyze the granular flows in the charging chute. Providing pre-calibrated material models, EDEM enabled the engineers to create and calibrate their EDEM model to match the physical experiments.

First, the engineers analyzed the segregation patterns in the trolleys of the sinter strand which were in good agreement with the experimental measurements at the plant. To find out whether finer materials would change the segregation pattern, they performed a sensitivity study using different particle sizes. The results of this analysis revealed that the size of the particles has no effect on the segregation patterns. In addition, to define the best charging practices with the DEM model to ensure even distribution, the team studied the effect of the filling ratio on granular flow patterns. The analysis of the flow pattern of coarse and fine particles showed that a large filling ratio leads to an even distribution while a low filling ratio has a negative effect. Using the results of their studies, the engineers then virtually tested different charging chute scenarios to find a design that meets all requirements regarding capacity and mechanical resistance.

## Results

The DEM simulation provided valuable insight into the granular flow in the charging chute and segregation patterns, which is difficult and sometimes impossible to measure in experiments. Thanks to EDEM's fast and scalable compute performance, ArcelorMittal R&D was able to simulate the complex particle system of the sinter cooler charging system and validate with plant data for segregation. The DEM model provided results that correlated well with the segregation measurements. Building a DEM particle model for agglomerate particles by a calibration procedure helped ArcelorMittal to define the best charging practices and change the charging chute design that acts on the segregation pattern in the trolleys.

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