

Evaluation of blended coking coal mixing to disintegrate quasi-particles applying Discrete Element Method

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ABSTRACT

Coal particles with high water-content unit together and grow into quasi-particles, then the strength of coke produced by carbonizing coal becomes weak¹⁾, which causes a problem in an operation of blast furnace as a following process. It is reported that blended coking coal mixing is effective to disintegrate quasi-particles and produce the high-strength coke²⁾. In this paper, suitable operating condition of continuous type mixer is suggested by applying discrete element method (DEM) as well as carrying out corresponding experiments.

The mixer is horizontal vessel and its size is 310mm ϕ \times 1000mm. It has a main shaft rotating 167 rpm with eight feeding blades and two choppers rotating up to 3600rpm. In experiment, testing coal includes 20% of tracer coal painted with fluorescent paint and contains 10% of water, which is formed into quasi-particles. After the testing coal is mixed by the mixer, pictures of mixed coal sample are taken under ultraviolet light. Area ratio of particles over 1mm in the image of mixed coal sample is calculated and evaluated as non-mixing degree. In DEM simulation, coal is treated as spherical particles, Hertz-Mindlin model is defined as contact model and equation of motion for each particle is solved. In order to save the calculation time, the size of coal particle is coarsen to be 12mm. During mixing, coal particles received collision pressure over 1MPa are considered as disintegrated. Disintegrated particle amount to total is calculated and evaluated as non-mixing degree. Both experiment and DEM simulation are performed by changing the conditions of rotating speed of choppers, the number of choppers and so on.

As the influence of rotating speed of choppers and number of choppers on mixing degree is similar between the experiment and the DEM simulation, mixing degree for variety of operating condition can be predicted using DEM simulation. It is founded that mixing degree is increased nonlinearly with respect to the chopper rotating speed, operating with two choppers is much better than that with one chopper and proper occupied volume has to be set.

REFERENCES

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