
# Soft-measuring models of thermal state in iron ore sintering process

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# Soft-measuring models of thermal state in iron ore sintering process

Xiaoxian Huang, Xiaohui Fan*, Xuling Chen, Min Gan, Xinze Zhao

School of Minerals Processing and Bioengineering, Central South University, Changsha 410083, Hunan, China

**Abstract:** Thermal state of iron ore sintering in iron and steel production cannot be revealed straightforward, which is unfavorable for field operations. In this paper, the soft-measuring models were established to extract the feature points through curve fitting method and evaluate the whole state via random forest algorithm. All the models proposed were validated by the industrial data, and the results show that feature extraction model can identify the variation of reaction zones, and evaluation model possesses a classification accuracy over 95%. The soft-measuring models were integrated into the automatic control system developed for sintering plant. Running results illustrate that the system can enhance the stable control and reduce the power consumption of sintering process.

**Keywords:** Iron ore sintering; Thermal state; Soft-measuring model; Evaluation model

## 1 Introduction

In iron and steel production enterprises, sintering is the most widely used agglomeration method for preparing blast furnace materials. In sintering process, the temperature variation is the main driving force of physical and chemical reaction. Reasonable thermal state is beneficial to improve the sinter quality [1,2]. Therefore, the detection and control of thermal state is the key step for realizing the optimization control of sintering process.

Sintering is a high-temperature reaction process, and it belongs to a semi-closed system. To obtain the thermal parameters inside sintering bed, numerical simulation [3-5] and soft-measuring technique are commonly used. But due to the incomplete detection of boundary conditions and long solving time, numerical simulation is not suitable for online application in operation field. Soft-measuring method has lower requirement for the integrity of original data, and its deployment is relatively simple, so it has been widely applied.

For the characterization of sintering thermal state, burn through point (BTP) is a most frequently used parameter, which indicates the completion position of sintering reaction. To estimate BTP, the exhaust gas temperature method is widely adopted [6-8], and the negative pressure method and exhaust gas composition method are also reported [9,10]. However, due to the air leakage from shrinkage cracks in sintering bed, the stability and accuracy of BTP are relatively lower. Moreover, the process control based on BTP has the drawback of large time delay. To avoid the above adverse effect, Keihin Iron and Steel Plant proposed the concept of Burn Rising Point (BRP) in early 1990s [11]. It refers to a certain position on the fitting curve of

* Corresponding author
*E-mail address*: csufanxiaohui@126.com (X.H. Fan)