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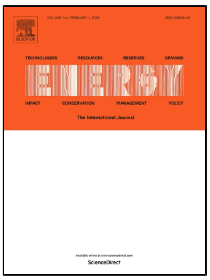

Research on Bottleneck of Slab Thermal Efficiency in Reheating Furnace Based on Energy Apportionment Model

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Research on Bottleneck of Slab Thermal Efficiency in Reheating Furnace Based on Energy Apportionment Model

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Abstract:

For revealing distribution law of slab thermal efficiency (STE) and its bottlenecks, slab region thermal efficiency (SRTE) model and STE model were established based on the energy apportionment model of reheating furnace in this paper. And the bottleneck index of slab thermal efficiency (BISTE), which could assess the influence of SRTE on STE in a region, was proposed. Firstly, the regional energy balance equation was listed based on reheating furnace region division. And then, SRTE model and STE model were established. Secondly, the bottleneck of slab thermal efficiency (BSTE) was achieved through partial correlation analysis (PCA) of billet samples, which were obtained according to difference of billet loading temperature and its residence time in reheating furnace. And then, the BISTE was put forward for accurately determine the BSTE. Finally, some suggestions or measures, which could improve SRTE, were proposed. Case study has shown validation of these models. And BISTE were 42% (Preheating), 19% (Heating II), 18% (Soaking), 11% (Heating I) and 10% (Preheating & Heating), respectively. Therefore, Preheating zone is the key region to improve STE.

Keywords: Reheating Furnace; Slab Region Thermal Efficiency; Slab Thermal Efficiency; Bottleneck Index of Slab Thermal Efficiency

1. Introduction

The iron and steel industry is an important pillar industry in national economic construction [1-2]. And with the rapid grown of world crude steel production in recent decades, the demand for energy is also increasing in iron and steel industry (especially in China) [3-4]. Therefore, iron and steel industry around the world are facing tremendous energy consumption pressure [5-9]. Meanwhile, high energy consumption can also exacerbate costs and CO2 emissions [10-15]. Accordingly, lots of advanced energy-saving technologies and methods have constantly emerged [16-21]. And energy efficiency of iron and steel industry has been greatly improved. However, the popularity of energy-saving technology in iron and steel industry still needs to be enhanced [22]. The reheating furnace is one of the main energy consuming equipment in the iron and steel enterprises [23]. Its energy consumption accounts for 15-20% of the total energy consumption and 70% of the energy consumption of the rolling process [24-25]. Therefore, the research on energy saving of reheating furnace has always been focused on by scholars.

2. Literature review

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