

## 钢铁行业碳达峰、碳中和实施路径研究

上官方钦<sup>1</sup>, 刘正东<sup>2</sup>, 殷瑞钰<sup>2</sup>

(1. 中国钢研科技集团有限公司钢铁绿色化智能化技术中心, 北京 100081;

2. 钢铁研究总院, 北京 100081)

**摘要:** 概括了中国钢铁行业绿色化发展进程, 即节能、减排、脱碳三个阶段; 分析了中国钢铁行业的 CO<sub>2</sub> 排放现状及实现碳达峰、碳中和的关键时间节点、思路、切入口和技术路线图等; 指出钢铁行业越早实现碳达峰, 越有利于后续碳“下坡”和碳中和的实现; 削减粗钢产出总量和流程结构调整发展全废钢电炉短流程钢厂是中国钢铁行业实现碳中和过程中的两大可行的抓手。

**关键词:** 碳达峰; 碳中和; 钢铁; 实施路径; 绿色化发展

## Study on the Implementation Path of Carbon Peak and Carbon Neutrality in the Steel Industry in China

Shangguan Fangqin<sup>1</sup>, Liu Zhengdong<sup>2</sup>, Yin Ruiyu<sup>2</sup>

(1. Steel Industry Green and Intelligent Manufacturing Technology Center, China Iron and Steel Research Institute Group, Beijing 100081, China; 2. Central Iron and Steel Research Institute, Beijing 100081, China)

**Abstract:** Green development process of the steel industry in China was summarized, which included three stages: energy saving, emission reduction and decarbonization. And the current situation of CO<sub>2</sub> emission in the steel industry in China and the key time nodes, ideas, cut-off points and technical roadmap to achieve carbon peak and carbon neutrality were analyzed in this paper. It is pointed out that the earlier the steel industry reaches the carbon peak, the more favorable it is for the subsequent ‘carbon downhill’ and carbon neutrality. However, reducing the total output of crude steel and adjusting the process structure are two feasible ways to realize carbon neutrality in the steel industry in China.

**Key words:** carbon peak; carbon neutrality; steel; implementation path; green development

## 生命周期评价方法在钢铁企业低碳发展规划中的应用

刘颖昊

(宝山钢铁股份有限公司中央研究院, 上海 201999)

**摘要:** 在当前“碳达峰”“碳中和”的背景下, 很多钢铁企业在制订低碳发展规划的过程中, 对于减碳措施的减碳潜力没有数字化的概念, 缺乏量化的评价手段和科学的数据支撑。为此, 提出应用生命周期评价(LCA)进行钢铁企业低碳发展规划的方法, 建立产品碳足迹与组织层级碳核算的关联。在此基础上, 通过建立覆盖全公司的产品

生命周期评价模型,以量化评估新技术新工艺应用、产品结构变化、能源结构变化、废钢利用率提升、节能减排改进、供应链优化等因素的对于企业组织层面的碳减排绩效,可实现数字化碳减排路线图的描绘。给出了钢铁企业主要措施与策略碳减排潜力的评价方法与案例,可为钢铁企业的低碳发展规划提供参考。

**关键词:** 碳达峰、碳中和; 低碳发展规划; 生命周期评价; 减排潜力; 数字化

## Application of Life Cycle Assessment in Low-carbon Planning of Steel Company

Liu Yinghao

(The Central Research Institute of Baoshan Iron and Steel Co., Ltd., Shanghai 201999, China)

**Abstract:** In the current context of "carbon peak", and "carbon neutrality", many steel companies are formulating low-carbon plans. However, they have no digital concept on the potential of carbon reduction measures, and lack of quantitative evaluation methods and scientific data support. A method for applying life cycle assessment (LCA) to low-carbon planning for steel enterprises was proposed, and the relationship between product carbon footprint and organization-level carbon accounting was established. On this basis, through the company-wide product life cycle assessment model, it was possible to quantitatively evaluate the carbon emission reduction performance of the strategies such as the application of new technologies and new processes, product structure changes, energy structure changes, increased utilization of scrap steel, energy conservation and emission reduction, and supply chain optimization at the company organization level. In this way, the digital carbon emission reduction roadmap could be described. Examples of how to apply LCA to access the carbon emission reduction potential of various measures were listed, which provide reference for the low-carbon planning of steel companies.

**Key words:** carbon peak and carbon neutrality; low-carbon planning; life cycle assessment; emission reduction potential; digitalization

## 碳循环-富氢低碳高炉炼铁技术

左海滨, 王静松, 薛庆国

(北京科技大学钢铁冶金新技术国家重点实验室, 北京 100083)

**摘要:** 在国家“双碳”目标驱动下,钢铁工业势必要加快其低碳化进程,一是为促进我国钢铁工业可持续发展及提高未来钢铁产品的国际竞争力,二是要为他新兴产业提供一定的碳排放容量。钢铁工业的低碳化是涉及技术、经济、环境、社会影响等多个方面的重要课题,尤其是超过世界50%产量的中国钢铁工业的低碳化必将为世界瞩目。本文基于中国钢铁工业长流程为主的特点,分析了我国钢铁工业低碳化的潜在路径,重点剖析了碳循环高炉、富氢高炉及碳循环耦合富氢高炉的节碳潜力。针对不同工艺流程的关键技术问题,如煤气加热、炉内煤气流分布、多相喷吹风口设计、原燃料适应性等进行了系统研究,为基于高炉的炼铁低碳化发展奠定基础。同时本研究也将为中国钢铁工业未来低碳化路径的选择提供理论指导与借鉴。

**关键词:** CO<sub>2</sub> 减排; 炼铁; 碳循环高炉; 富氢高炉