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SEPTEMBER, 15 - 17, 1988.

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沈阳冶金石灰、精炼粉剂、浇铸保护渣
国际技术交流和学术讨论会论文集

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PREFACE

In recent years following the rapid development of technologies of iron and steelmaking processes including BOF slag control, hot metal treatment, ladle metallurgy and the protective processes during casting of steel, the manufacture and application technologies of slagformers, powders, refiners and cast mold fluxes have also been developed correspondingly.

With the aims to provide an opportunity to metallurgists working in these fields, to company managers who are offering or using above mentioned technologies and materials, to exchange their ideas and experiences, technical or cemmercial informations, the presentations at present Shenyang International Symposium are concentrated on the following three topics:

- LIME BASED SLAGFORMERS;
- REFINING AND ALLOYING POWDERS/CORED WIRES;
- CASTING MOLD FLUXES.

48 papers in this proceedings will be present to about 200 participants coming from 15 countries. There also is a drawings, pictures and product ,samples display available at the Symposium for detailed technical and commercial discussions. With the consideration of this proceedings to be available also to all chinese participants and readers in industry, a detailed astract in Chinese for each paper is given on the previous page of the concerned paper.

The Symposium Secretariat and the Organizing Committee would like to give a notice of thanks for financial support in printing present Proceedings to: The Research Institute of Metallurgy and The Department of Ferrous Metallurgy of Northeast University of Technology, Beijing Central Research Institute of Iron and Steel, Beijing University of Science and Technology, Shanghai University of Technology Chongqing University, Anshan Coking & Refractory Consulting Corporation, Helongjiang Research Institute of Metallurgy, Benxi Iron and Steel Company, Anshan Iron and Steel Company and Dalian Steel Plant.

前　言

近些年来，围绕转炉炼钢强化技术、浇钢过程的保护技术以及炉外精炼和铁水预处理技术的开发和应用，冶金辅助材料技术也相应地有了重要发展，其中主要有转炉用活性石灰、喷吹用粉剂、精炼用线剂和浇铸用保护渣等。

为了交流这方面工作的经验和信息，特别是为了促进这些先进技术在中国的推广应用，本次会议组织了澳大利亚、英国、埃及、法国、芬兰、印度、意大利、日本、挪威、瑞典、瑞士、美国、苏联、南斯拉夫和中国等十五个国家近二百专家和企业界代表，汇集沈阳。征集了48篇论文，就钢铁工业中的冶金石灰、精炼粉剂和浇铸保护渣技术进行专题性的学术交流和技术交流。与会议并行，还组织了有关样品和图片展览以及会余洽谈和交流活动。

为了便于中国代表和国内读者参阅论文，文集中附加了详细中文摘要。

本文集是在本溪钢铁公司、鞍山钢铁公司、大连钢厂、小岭钢铁厂、东北工学院冶金研究所、东北工学院钢铁冶金系、北京钢铁研究总院、北京科技大学、上海工业大学、鞍山焦耐院、重庆大学、黑龙江冶金研究所等单位的支持和资助下出版的。特此致谢。

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学术委员会
秘　书　处

一九八八年九月

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I. MANUFACTURE AND APPLICATION OF LIME BASED SLAGFORMERS IN STEELMAKING INDUSTRY

炼钢石灰的生产和应用

世界炼钢工业现代化石灰生产车间

中 文 摘 要

F.施瓦尔茨科普夫 O.耶纳
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本文讨论了炼钢用轻烧石灰的五种不同锻烧方法，探讨了炼钢石灰熔剂的质量要求，列出了四家石灰厂概况，最后分析了美国典型石灰厂设备投资和操作成本。

大型轻烧石灰的生产方法与设备：能够生产炼钢用轻烧石灰的方法并不多，特别是生产量大、能耗低的工艺更少。可采用的仅有带预热室的回转窑和结构复杂的竖窑。

带预热室的回转窑：无预热室回转窑可生产质量良好的轻烧石灰，但油耗太高。竖窑生产的石灰质量差，但燃料消耗较低，生产率高。二者结合所形成的带预热室式回转窑兼顾了上述两种方法优越性，结构参见图1－3。表1列出了预热室生产能力与单位燃料消耗的关系，表2比较了不同方法锻烧石灰的脱硫能力。

环状竖窑：环状竖窑和平行流竖窑可生产轻烧石灰，且能耗较低，但生产能力较小（最大600吨/日），对原料和燃料含硫要求严，分别为0.03%和0.5%。环状竖窑结构见图5。

平行流竖窑：平行流竖窑由底部相连上部分开的两个竖窑组成（见图6）。其气体流动方向可定期转换，但最重要的特点是锻烧期间气体顺流流动，可有效防止石灰过烧，它的燃料单耗最低，而电耗高于环状竖窑。

双斜窑和多膛窑：双斜窑开发于西德，适于小规模生产（50－200吨/日），其结构见图7，该法锻烧的石灰稍硬，烧损达2%，但燃料单耗和电耗低。

多膛窑结构见图8，它的性能与双斜窑相近，通常由4－6个锻烧室构成。两种窑均加入部分固体燃料（如焦炭）以降低总燃料单耗。

炼钢石灰熔剂的质量要求：BOF炼钢用石灰熔剂的要求包括化学纯度、粒度分布和活性。表3和表4列出了北美和西德炼钢生产的典型BOF石灰性能。西德几乎不用白云石型生石灰，其它性能两者非常相似。底吹转炉需要细磨石灰，但是化学纯度与氧气顶吹转炉所用石灰类似。铁水的炉外脱硫用石灰要求粒度更细，且CO_2含量和烧损值要低。表5为"流体"石灰的典型粒度分布和化学规格。

钢厂石灰车间的布局及操作：

钢厂的石灰车间没有统一的布局，要由生产规模、原料和工厂条件决定。真正钢厂所属的只生产BOF用石灰的石灰车间操作条件很宽松，生产的石灰可能烧损稍高，活性稍差或多样化，但很难商品化。它们通常采用一种工艺多台设置的方式满足扩建需要。文中概括了北美 等国石灰车间生产特点。

美国石灰厂的投资和操作成本：文中列表（表8）比较了300、600和1000吨/日规模的带预热室和接触冷却器的回转窑和300及600吨/日的平行流竖窑的设备投资。表9列出了带预热室的气体点火回转窑年平均操作成本的计算结果。

Modern Captive Limeplants in the World Steel Industry.

by

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Savannah, Georgia, USA.

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Duesseldorf, West Germany.

Abstract

Five different lime calcining systems capable of producing soft burned quicklime for steel production are described and their performance is discussed -

Rotary kiln with preheater and contact cooler
annular shaft kiln
parallel flow shaft kiln
double inclined kiln
multi chamber shaft kiln

Quality requirements for steel flux lime are discussed, BOF pebble lime, ground quicklime for bottom blown converters and fluid lime for external ladle desulfurization.

Four lime plants manufacturing steel flux lime are described and their performance characteristics are given.

Typical lime plant equipment costs for two systems and U.S. operating costs are included.

MODERN CAPTIVE LIME PLANTS IN THE WORLD STEEL INDUSTRY

INTRODUCTION

In 1987 a total of 15.2 million tons of lime were produced in the United States, approximately 30% of this production went to the steel industry as flux. The U.S. consumption of lime for steel making in 1986 was 4.69 million tons or 32% of the total lime production of 14.47 million tons.

In West Germany, another major steel producing country, 1.98 million tons of lime was used by the steel industry or 35% of the total production of 1987. Steel production in West Germany decreased from 37.1 million tons to 36.2 million tons in the years 1986 and 1987; therefore, lime production for steel also dropped by 8.2%. Similar lime production totals and steel use percentages apply to all other major steel producing countries.

Lime is a major raw material for steel production and all or most of it is soft burned lime, a very reactive material with a high surface area which dissolves quickly in the slag removing undesirable elements from the charge in the vessel.

In this paper we discuss the following topics:

1. Processes and equipment for high tonnage production of soft burned quicklime.
2. Quality requirements for steel flux lime and typical lime consumption for steel making.
3. Typical plant descriptions of lime plants producing steel flux at different capacities and operating characteristics.
4. Typical investment costs and operating costs in the U.S.A.