

Reuse and Reproduction of Used Refractories

LIU Zhi-xin^{1,2} YU Yan-wen²

(1. School of Metallurgy and Ecological Engineering, University of Science and Technology of Beijing, Beijing 100083, China; 2. Baosteel Iron & Steel Co., Ltd. Shanghai 200941, China)

Abstract: The paper analyzed the recycle condition and developing trend of used refractories in China and other countries, including research achievements of recycles of used refractories such as MgO-C bricks, Al₂O₃-MgO-C bricks, Al₂O₃-SiC-C castable and MgO-Cr₂O₃ bricks. Recycled refractories exhibit the same or even better properties compared with the original. In addition, prospects for recycle of used refractories are also discussed.

Key words: used refractories; recycle; disposal; magnesia carbon brick; alumina silicon carbide castable; magnesia chrome brick
CLC number: TQ317 **Document code:** A **Article ID:** 0529-6579 (2007) S1-0063-02

1 Introduction

About 9 millions tons of refractories are consumed in China annually owing to the rapid development of the metallurgical industry, from which more than 4 million tons of used refractories are inevitably generated^[1-2]. Most of used refractories are obsolescence, and only a minority is recycled as raw materials for refractory products^[3-4]. Discard of used refractories not only is lavish the natural resources but also is harmful to the environment. Pollution of used refractories include following aspects of: 1) dust; 2) anthraco silicosis caused by crystalline silica dust; 3) radioactivity of zirconia raw material; 4) carcinogenicity of Cr⁶⁺; 5) carcinogenicity of refractory fiber and asbestos; 6) pollutant from volatile and thermal decomposed substance of pitch and resin. Used refractories can be even processed into raw materials with high price, performing as high-quality second resources. Not only saving mineral resources and energy and reducing the environmental pollution, but also saving the cost of refractory and steel making, recycle of used refractories becomes an important cause to refractory enterprises.

2 Circumstances for used refractories in China

Baosteel pays great attention to reuse and reproduction of used refractories. Combine reuse and reproduction of used refractories with cutting down cost and increasing benefit, protecting environment and

advancing enterprise level. Accelerate research and development on used refractories. The research results are reported as follows.

Used MgO-C bricks for BOF and LF lining are selected to remove sundries such as dirt, slag and iron scraps, which decrease seriously the quality of reproduced refractories. Properties of MgO-C brick reproduced are shown in table 1.

Tab 1 Properties of MgO-C brick reproduced at R&D Baosteel

MgO	80	76	80	77
C	12	14	11	14
Cold rush Strength/MPa	60	52	60	52
Bulk Density/(g·cm ⁻³)	3.04	3.01	3.08	3.04
Apparent Porosity/%	3	2	3	2
Hot Modulus Of Rupture/MPa	13	12	13	12
Added ratio of used MgO-C brick/%	97	97	80	80

The MgO-C brick reproduced was used slagline of 300 t ladle and service life reaches 82 heats that contains 20 heats ladle furnace. Maximum wear speed at slagline is

1.28mm/heat, and original MgO-C brick is 1.40mm/heat. Therefore, the performance of the reproduced MgO-C brick reaches level of original MgO-C brick. Pictures of remnant used brick is shown fig 1.

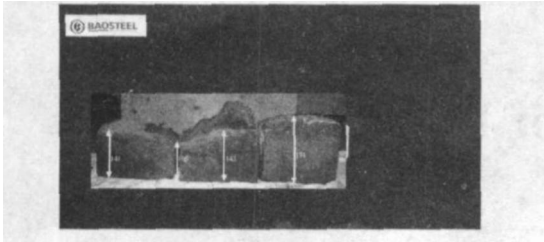


Fig 1 Appearance of used MgO-C bricks reproduced
MgO-C castable is developed by using used MgO-C brick as raw material

Tab 2 Properties of magnesia chrome bricks reproduced

MgO		60
Cr ₂ O ₃		18
180℃, 24h	Bulk density/(g·cm ⁻³)	3.12
	Apparent porosity/%	13
	Cold crush strength/MPa	64.3
1750℃, 3h	Bulk density/(g·cm ⁻³)	3.14
	Apparent porosity/%	17.7
	Cold crush strength/MPa	48.7
Added ratio of magnesia chrome brick used/%		> 70

Baosteel developed used magnesia chrome brick for RH before 10 years, 20% used magnesia chrome brick was added into gunning mix for RH, and achieved favorable service result. Reproducing magnesia chrome brick is researched recently. Experimental result is shown in table 2. We have studied on AMC

brick and ASC castable with AMC brick used for ladle and ASC castable used for iron runner system.

3 Prospect

Used refractories can reduce the cost of raw material for refractories and metallurgy auxiliary material. The reuse ratio on of used refractories is very low in Baosteel at present, but R&D has been carried out. Pattern of reuse and reproducing on used refractories is diversification, i.e. consumer uses directly, refractories plant recycles, building professional plant reclaiming used refractories and they unite. The key to success is developing and researching high technology on reuse and reproduction of used refractories. Reuse and reproduction of used refractories is also a contribution on environment protection, and so, reuse and reproduction of used refractories increases rapidly. Trend of zero discard has been indicated.

References

[1] TIAN SX. Progress of slide plate reuse [J]. Foreign Refractories, 1997 (8): 16—21.
[2] PEASLEE K D, SMITH J D, FANG H. Electric Furnace Conference Proceedings, Recycling/Reuse techniques for spent refractories from steel producers [J]. 1998, Japan.
[3] Electric steel making. Reuse of waste brick for steel making, 1997(4): 299—300.
[4] Foreign Refractories. Reuse and reclamation of refractories used, 2001(7): 36—38.

用后耐火材料的再生利用

陆志新^{1, 2}, 于燕文²

(1. 北京科技大学冶金学院, 北京 100083; 2 上海宝钢股份有限公司, 上海 200941)

摘 要: 综述了国内外对用后耐火材料的再利用情况和发展趋势, 报导了宝钢对用后镁碳砖、铝镁碳砖、铁沟料和镁铬砖等的再利用研究成果。再生耐火材料的性能接近或达到新产品的水平, 甚至有些能达到优质耐火材料的水平。扼要介绍了用后耐火材料再生利用的设想。
关键词: 用后耐火材料; 再生; 废弃物; 镁碳砖; ASC材料; 镁铬材料
中图分类号: TQ317