

高炉炉缸 整体浇注修复技术

PUMPCAST MONOLITHIC
CERAMIC-CUP FOR REPAIRING
BLAST-FURNACE CRUCIBLE HEARTH



联合荣大企业集团
Allied Rongda Enterprises

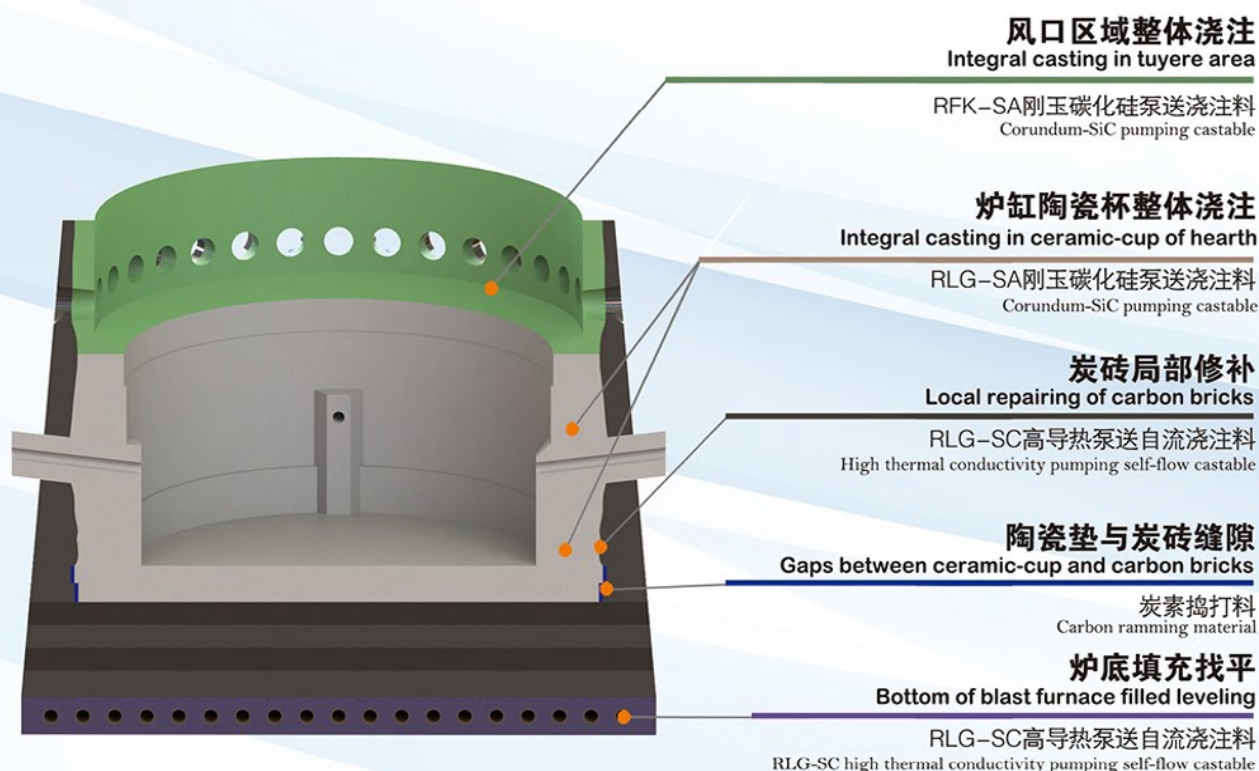


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Pumpcast Monolithic Ceramic-Cup For Repairing Blast-Furnace Crucible Hearth

高炉炉缸整体浇注修复技术是一种快速重构高炉炉缸陶瓷杯与安全传热结构的新技术。高炉炉缸使用后期，初始陶瓷杯消失，炭砖因溶蚀、磨损、侵蚀而变薄，炉缸散热热流强度变大，且炭砖直接与铁水接触，存在炭砖持续溶蚀变薄而渗铁漏铁的隐患。本技术直接在变薄的炉缸炭砖层上浇注一层耐高温、抗渣侵蚀、不溶于铁水的整体无缝陶瓷杯，阻隔炭砖与铁水直接接触，既阻止炭溶解，也降低炉缸散热热流强度，将1150℃凝铁等温线推至陶瓷杯内表面，形成一定厚度的动态、稳定的高粘度渣铁粘滞层，起到保护炉缸耐火材料，延长炉缸耐材使用寿命的作用。

The monolithic casting repairing technology of blast-furnace hearth is a new technology by which the ceramic-cup of blast-furnace hearth and the safe heat transfer structure can be rapidly reconstructed. On the final term of hearth using, the initial ceramic-cup disappeared, and the carbon bricks are thinner than before due to corrosion, wear and erosion. The heat transfer intensity increases, and the carbon brick contact directly with molten iron. So there are hidden dangers of iron leakage because of constant dissolving of the thinner carbon bricks. A whole and seamless ceramic-cup that can withstand high temperature and slag corrosion and do not dissolve in metal iron is casted on the thinner ceramic-cup by this technology. The ceramic-cup stops carbon bricks to contact with molten iron. It can not only prevent carbon dissolving but also reduce the heat transfer intensity of hearth. The 1150°C congeal iron isotherms is pushed to the inner surface of ceramic-cup. A dynamic and stable layer with a certain thickness is formed to protect the refractory and extend the using life of hearth.





联合荣大高炉炉缸整体浇注修复技术系统解决方案

The system solutions of integral casting repairing technology of blast-furnace hearth

■ 包括材料、装备与施工 Refractories、equipment and installation

所用材料是专门针对高炉炉缸工艺环境开发的溶胶结合刚玉碳化硅泵送浇注料，该材料具有优良的抗渣铁侵蚀、抗冲刷性能，并具有可泵送与快干防爆的性能。高导热浇注料具有和微孔炭砖相近的导热能力，专用于炭砖的修复。

联合荣大拥有十多套高效连续搅拌与泵送集成装备，和经验丰富的成建制高素质专业施工队伍，可快速完成炉缸修复施工，连续泵送作业效率可达15t/h以上。

The sol-bonded corundum-SiC pumping castable is developed as per the technological environment of blast furnace hearth. The castable can be pumped and has many application advantages, such as high anti-dregs iron corrosiveness and anti-dregs iron erosion. The conductive capacity of high thermal conductivity castable that is used in repairing of carbon bricks is close to that of micro-pore carbon brick.

Allied Rongda enterprises has more than 10 sets of high efficient continuous mixers and pumping equipments, and professional construction teams. We can complete the repairing of hearth quickly. The pumping efficiency can be more than 15t/h.

■ 技术经济优势 Technical and Economical Advantages

- 1、修复后的炉缸为薄壁炭砖+陶瓷杯结构，炉缸传热系统更加有效合理；
- 2、陶瓷杯与炭砖无缝粘合，避免了传统捣打料层收缩气隙导致的热阻增大问题；
- 3、整体浇注陶瓷杯结构完整，避免了传统砌筑陶瓷杯砖缝众多的隐患；
- 4、只需要局部拆除严重粉化炭砖进行局部修复，最大限度利用残砖，降低材料消耗；
- 5、泵送浇注施工速度快，且材料快干防爆，通常一周左右可完工。

- 1、The re-organized structure of hearth repaired is thin-walled carbon brick+ceramic cup, the conductive system of hearth is more effective and reasonable.
- 2、The casted ceramic cup sticks with carbon bricks. This prevent the thermal resistance increasing caused by gaps because of shrinkage of the traditional ramming material between ceramic-cups and carbon brick layer.
- 3、The structure of ceramic-cup by this method is monolithic, much better than brick system which consists of countless seams.
- 4、We just need to tear down the carbon bricks damaged seriously and repair the hearth locally. By this way, the residual carbon bricks can be used mostly, so the material consumption reduces.
- 5、The efficient pumping installation process and anti-explosive performance of castable, which permits quick drying, assure the repairing project being finished within a week or so.

■ 应用 Application

高炉炉缸整体浇注修复技术，可应用于炉缸重造陶瓷杯（陶瓷杯壁和陶瓷杯垫）整体浇注，铁口区域浇注修复、风口带整体浇注（代替风口组合砖）等工程。

The monolithic casting repairing technology of blast-furnace hearth can be used in the rebuilding of ceramic-cup (ceramic wall and bottom)、the repairing of taphole、casting in tuyere area (instead of tuyere combined bricks).

材料性能指标 Material properties

项目 Items	材料 Material	陶瓷杯泵送自流料 Ceramic-cup pumping self-flow castable	高导热泵送自流料 High thermal conductivity self-flow castable
	牌号 Brand	RLG-SA	RLG-SC
化学成分 (%) Chemical component	Al ₂ O ₃	≥70	≥8
	SiC+C	≥15	≥75
	CaO	≤0.5	≤0.5
体积密度 (g/cm ³) Bulk density	110℃ × 24h	≥2.95	≥2.4
抗折强度 (MPa) Rupture strength	850℃ × 3h	—	≥6
	1450℃ × 3h	≥11.7	≥8 (1200℃ × 3h)
耐压强度 (MPa) Compression strength	850℃ × 3h	—	≥35
	1450℃ × 3h	≥50	≥50 (1200℃ × 3h)
导热系数 (W/m.k) Thermal conductivity	800℃	—	≥12
永久线变化率 (%) Permanent line change	1450℃ × 3h	±0.5	±0.2 (1200℃ × 3h)

工程图片示例 Engineering pictures



炉缸清理
Hearth cleaning



清理碳砖的氧化粉化层
The oxidative layer of carbon bricks cleaning up



局部补砌碳砖
Carbon bricks supplementing



喷涂界面处理剂
Treatment agent on spray interface



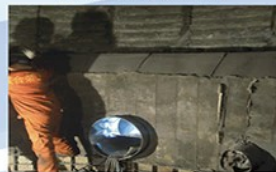
确认中心
Confirmation center



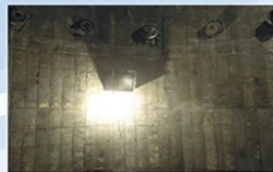
模具支设
Erection of molds



泵送浇注
Pumping pouring



模具拆除
Mold dismantling



脱模外观
Demoulding appearance

部分业绩表 Partial User List

客户名称 Customers	高炉编号 (#) Number of BF	高炉容积 (m ³) Volume of BF	施工日期 Instruction date
燕山钢铁有限公司 Yanshan iron and steel Co.,Ltd.	3	2560	2012/03/17
西林钢铁集团有限公司 Xilin iron and steel Co.,Ltd.	4	1080	2012/12/07
燕山钢铁有限公司 Yanshan iron and steel Co.,Ltd.	4	2560	2013/02/18
唐山国丰钢铁有限公司 Tangshan guofeng iron and steel Co.,Ltd.	5	450	2013/05/05
西林钢铁集团有限公司 Xilin iron and steel Co.,Ltd.	5	1260	2013/05/19
潍坊特钢集团有限公司 Weifang special steel group Co.,Ltd.	1	1186	2014/02/20
陕西略钢钢铁有限公司 Shanxi luegang iron and steel Co.,Ltd.	3	450	2014/03/05
唐山国丰钢铁有限公司 Tangshan guofeng iron and steel Co.,Ltd.	1	450	2014/05/05
河北钢铁集团鑫达钢铁有限公司 Hebei xinda iron and steel Co.,Ltd.	2	450	2014/08/28
陕西略阳钢铁有限公司 Shanxi lueyang iron and steel Co.,Ltd.	1	450	2014/10/18
燕山钢铁有限公司 Yanshan iron and steel Co.,Ltd.	1	1080	2014/11/01
邢台钢铁有限责任公司 Xingtai iron and steel Co.,Ltd.	5	450	2014/11/07
玉溪新兴钢铁有限公司 Yuxi Xinxing steel Co.,Ltd.	2	450	2014/11/19
唐山东海钢铁有限公司 Tangshan donghai iron and steel Co.,Ltd.	1	1080	2015/02/22
唐山东海钢铁有限公司 Tangshan donghai iron and steel Co.,Ltd.	2	1080	2015/03/05
首钢长治钢铁有限公司 Shougang changzhi iron and steel Co.,Ltd.	3	350	2015/03/25
山西中升钢铁有限公司 Shanxi zhongsheng iron and steel Co.,Ltd.	1	1300	2015/03/30
新疆阿勒泰金昊铁业有限公司 Xinjiang jinhao steel industry Co.,Ltd.	2	530	2015/05/02
新疆阿勒泰金昊铁业有限公司 Xinjiang yili steel industry Co.,Ltd.	1	530	2015/05/06
新疆伊犁钢铁有限责任公司 Xinjiang yili steel Co.,Ltd.	2	530	2015/05/29
河北唐银钢铁有限公司 Hebei Tang Yin steel Co.,Ltd.	3	1080	2016/02/19
廊坊洸远金属制品有限公司 Langfang Guangyuan metal products Co.,Ltd.	2	630	2016/02/25
唐山金马工业公司 Tangshan Jinma industry company	4	240	2016/05/31
宁夏申银特钢股份有限公司 Ningxia Shenyin steel Limited Co.,Ltd.	-	1180	2016/07/15
山东球墨铸管有限公司 Shandong Ductileironpipes Co.,Ltd.	2	350	2016/10/28
安阳汇鑫特钢有限公司 Anyang Huixin special steel Co.,Ltd.	1	580	2016/12/31
中钢特材科技 (山西) 有限公司 Sinosteel Special Material Technology(shanxi)Co.,Ltd.	2	450	2017/01/27

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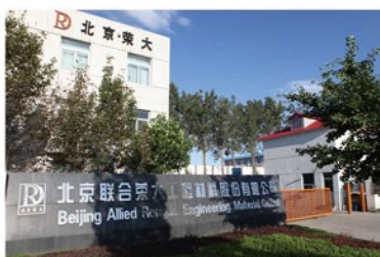
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