



RHI MAGNESITA

GLASS / CHROME CORUNDUM

玻璃行业用铬刚玉耐火砖

—
Chrome Corundum Refractory Bricks
for the Glass Industry Chrome





There for you, wherever you need us



The more closely we work with our customers, the greater the difference we can make for them. So having a global network of offices, research centers and production sites is important to us, and to them. We'll go on extending our global reach, to be nearer to even more customers.

Being closer to customers doesn't just mean we can be more responsive to their needs. It also helps us to listen better — to understand their concerns, cultures and ways of working. And to be alert to new thinking and ideas that enable us to deliver ever better advice, service and solutions.

Our exceptional resources and expertise extend far beyond making and selling products. We also provide solutions to customers worldwide for cover projects, materials specification, thermal studies, numerical simulations, follow-up and technical support in application of minerals, and maintenance and electromechanical services for refractory equipment.

RHI Magnesita concentrates its worldwide activities for the glass industry in the Business Unit Industrial Projects and offers customized all-inclusive solutions which additionally include:

- resource-saving production to protecting the environment
- energy-efficient lining concepts for the customers
- Manufacturing in accordance with ISO-certified environmental and quality assurance standards in all our plants world wide.



28
Main production and raw material sites

5
R&D hubs and centers

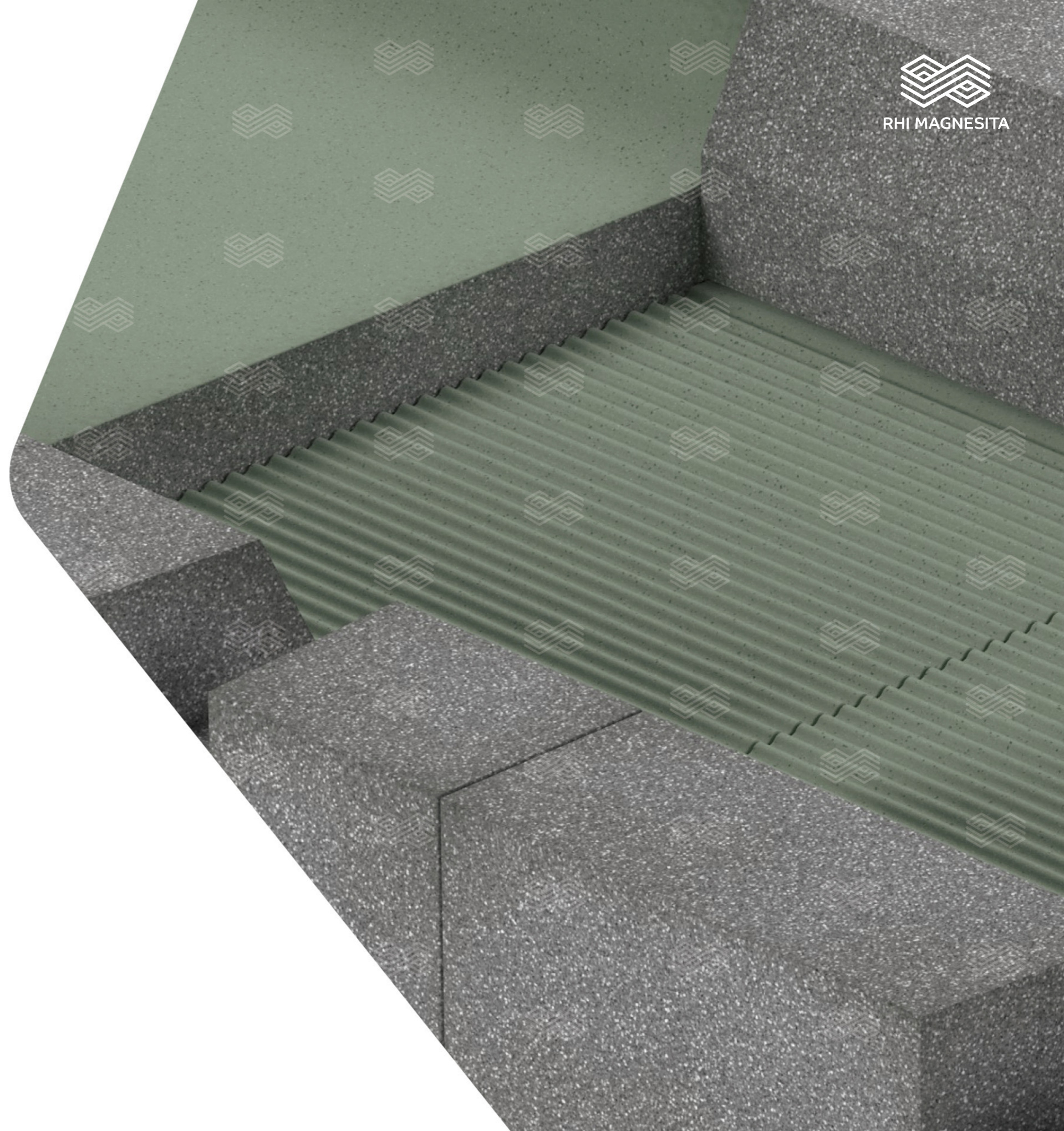
70+
Sales offices around the world

125+
Countries customers are served

Content

Chrome Corundum Refractory Bricks for the Glass Industry

- Chrome Corundum Refractory Bricks — Applications
铬刚玉耐火砖 — 应用
- Chrome Corundum Refractory Bricks — Technical Information
铬刚玉耐火砖 — 应用
- Vibrocast Products
振动浇注产品
- Customer-oriented System Solutions — Refractory Recycling
以客户为导向-系统方案 — 耐火材料回收
- Fiberglass Tank
玻璃纤维窑



铬刚玉耐火砖 — 应用

- 保温玻璃纤维和矿棉生产中玻璃接触部位
- 玻璃熔炉池壁的外部贴砖
- 专用玻璃熔炉上部结构和小炉口配置
- 高应力蓄热室中的小炉口颈部和靶墙
- 钠钙玻璃熔炉中的高应力区域，例如加料池拐角、窑坎和流液洞

在所有工业用耐火氧化物中，氧化铬对熔融玻璃的耐腐蚀性最高。因此，它可用于腐蚀应力极高的玻璃熔炉。

多年以来，特定熔炉部分已经采用了氧化铬陶瓷结合耐火砖，如加料池拐角、窑坎和流液洞，并成功取代了等静压氧化铬产品。在生产腐蚀性玻璃纤维和矿棉时，所有玻璃接触区域都可采用氧化铬陶瓷结合耐火砖。在高应力电熔炉中，氧化铬陶瓷结合耐火砖可以确保熔炉正常运行四到五年。



Chrome Corundum Refractory Bricks — Applications

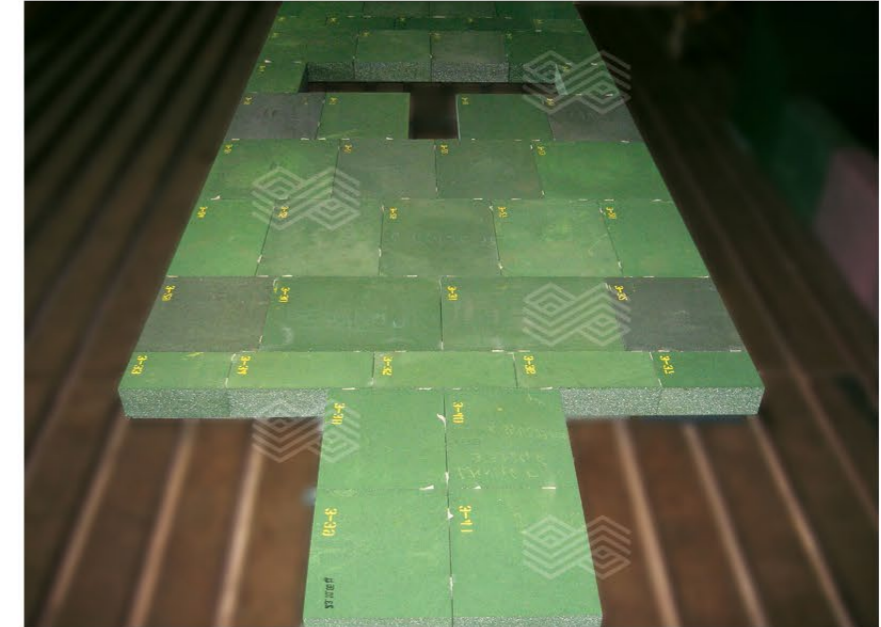
- Glass contact in the production of insulating fiber glass and mineral wool
- Overcoating tiles for glass tank sidewalls
- Lining of superstructure and port mouth for special glass furnaces
- Port necks and target wall in heavily stressed regenerators
- Highly stressed areas in soda lime glass furnaces, e.g. doghouse corners, weir wall and throat

Of all the refractory oxides used in industry, Cr_2O_3 is the one with the highest corrosion resistance to molten glass. For this reason it is used in glass furnaces where extreme corrosion stress is expected.

Ceramically bonded refractory bricks based on chromium oxide have been installed in specific furnace areas such as the doghouse corner, wall and throat for many years and have successfully replaced isostatically pressed chromium oxide products there. In the production of aggressive fiberglass and mineral wool, they are applied in all areas having glass contact. In highly stressed electric melting furnaces these bricks enable furnace campaigns of four to five years.

自2000年以来，RHI Magnesita为50多个玻璃纤维熔炉提供材料，这些熔炉大部分或完全配置铬刚玉砖。我们通过不断改进耐火材料，实现了良好的耐火结果。RHI Magnesita的产品系列中的氧化铬含量可以达到10%至70%。

Since the year 2000, RHI Magnesita has supplied materials for over 50 fiberglass furnaces which are to a great extent or completely lined with chrome corundum brick grades. The positive results were achieved by a continuous improvement of these materials. The product line of RHI Magnesita features grades containing 10 to 70% chromium oxide.



Content



Bricks



Grades



Solutions



Lining



铬刚玉耐火砖 — 技术信息

RHI Magnesita铬刚玉产品的矿物成分以氧化铝/氧化铬固体和斜锆石 (ZrO₂) 为主。氧化铬含量较低的产品中含有游离刚玉。氧化铝/氧化铬固体尤其受客户欢迎，因为它比纯刚玉更耐腐蚀并且比纯氧化铬更不易于形成铬酸盐。在传统铬刚玉砖生产工艺中，分别添加刚玉和氧化铬。主要在烧制过程中形成以及在使用过程中形成固体。RHI Magnesita的DURITAL RK 3OS、DURITAL RK 5OS、SUPRAL RK 3OS和SUPRAL RK 5OS产品采用回收原料预反应熔融铬刚玉制成。因此，在使用中，耐腐蚀固体可以立刻发挥作用。新型DURITAL RK55S和SUPRAL RK55S具有更高的耐腐蚀性，应为它们的主要原材料为熔融铬刚玉，具有更高纯度水平，并且耐腐蚀性几乎可以达到等静压氧化铬的水平。

Chrome Corundum Refractory Bricks — Technical Information

The mineralogical composition of the RHI Magnesita chrome corundum grades is dominated by Al₂O₃/Cr₂O₃ solid solution and baddeleyite (ZrO₂). Grades with a lower Cr₂O₃ content also have free corundum. The Al₂O₃/Cr₂O₃ solid solution is particularly favorable, as it is more corrosion-resistant than pure corundum and less susceptible to chromate formation than pure chromium oxide. During the classical production process of chrome corundum bricks, corundum and chromium oxide are added separately. The solid solution only forms during firing and mainly later in service. The RHI Magnesita grades DURITAL RK 3OS, DURITAL RK 5OS, SUPRAL RK 3OS and SUPRAL RK 5OS are produced with pre-reacted fused chrome corundum from recycled raw materials. In service, the especially corrosion-resistant solid solution is therefore active from the start. An even higher corrosion resistance is exhibited by the new grades DURITAL RK55S and SUPRAL RK55S. They are based on fused chrome corundum from primary raw materials with a much higher purity level and their corrosion resistance nearly reaches the level of isostatically pressed chromium oxide.

基于氧化铬含量，上述材料的耐腐蚀性等于或显著高于电熔AZS材料的耐腐蚀性

压制SUPRAL块的制造尺寸可以达到1500x500x300 mm，采用六面磨光，确保接缝绝对紧密。此外，耐火砖预先组装以确保相互之间的精密配合。

另一个优点是与熔铸AZS砖的异常膨胀相比，铬刚玉砖能够实现线性热膨胀 - 特别是与玻璃接触区域。由于其结构灵活性较高，材料中的热应力较低。另外，微结构中的氧化锆颗粒具有快速封堵初始裂缝的作用。因此，铬刚玉砖具有良好的抗热冲击性，特别是与等静压成型耐火砖相比更具优势。因此，铬刚玉砖非常适用于高应力炉区，是检修工作的最佳材料，例如在液面线区域外部贴砖。由于其优越性能，铬刚玉砖在市场上越来越受欢迎。

Corrosion resistance of these materials is, depending on the Cr₂O₃ content, comparable to or significantly higher than that of fused cast AZS materials.

Pressed SUPRAL blocks can be manufactured with dimensions up to 1500x500x300 mm. All surfaces are ground on six sides so that joints are absolutely tight. Furthermore, the bricks are preassembled to ensure precise fitting.

Another advantage — especially in contact with glass — is the linear thermal expansion of chrome corundum bricks compared to the abnormal expansion of fused cast AZS bricks. Due to the high degree of structural flexibility the thermal stress in the material is reduced. Additionally, the zirconia grains in the microstructure have the effect that initial cracks are stopped quickly. Thus chrome corundum bricks possess good to superb thermal shock resistance, particularly compared to isostatically-pressed grades. Therefore, chrome corundum bricks are very well suited for highly stressed furnace areas and are the optimum material for repair jobs, e.g. overcoating tiles in the area of the flux line. They increasingly prevail on the market due to their outstanding performance.

SUPRAL RK5OS

AZS33

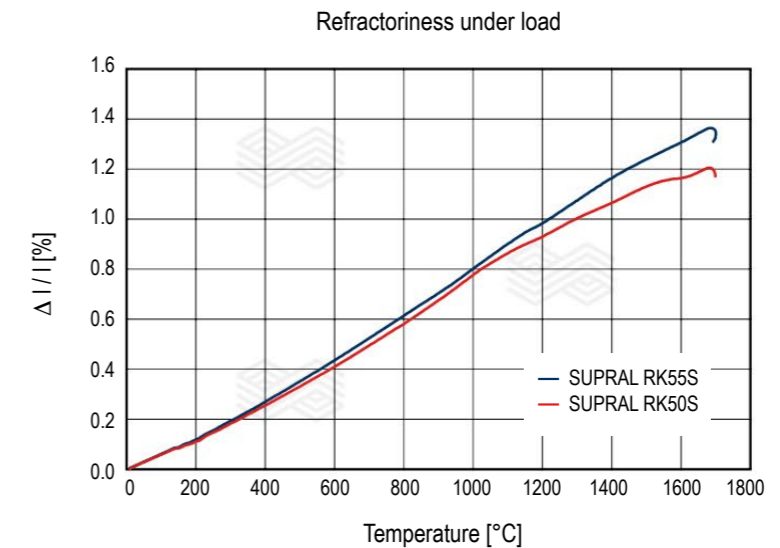
SUPRAL RK55S

ISO-Chrome



SUPRAL RK5OS与电熔AZS的耐腐蚀性对比 / Corrosion of SUPRAL RK5OS compared to fused cast AZS

等静压氧化铬与SUPRAL RK55S的耐腐蚀性对比 / Corrosion of SUPRAL RK55S compared to isostatically pressed chromium oxide



现有铬刚玉牌号 / Available chrome corundum grades

Grade		Cr ₂ O ₃	Al ₂ O ₃	ZrO ₂	BD	AP	RUL T _{0.5}	TE	TSR		典型应用	Typical applications
Old name	New name	%	%	%	g/cm ³	vol.%	°C	%	Cycles			
DURITAL RK10	DURITAL RK10	10.5	85.0		3.33	15.5	> 1700	1.3	15		所有熔窑: 烧嘴砖, 烟道进口, 炉底安全层 保温棉玻璃炉: 上部结构, 大碓	All furnaces: Burner block, flue gas channel entrance, safety layer in furnace bottom Fiberglass furnace: Superstructure, crown
DURITAL RK30NP	DURITAL RK30NP	29.0	64.0	2.0	3.50	15.7	> 1700	1.2	> 30		所有熔窑: 贴补用砖	All furnaces: Overcoating tiles
	DURITAL RK30NP-IN	30.0	65.0	1.5	3.40	16.0	> 1700	1.2	> 30		所有熔窑: 贴补用砖	All furnaces: Overcoating tiles
DURITAL RK30S	DURITAL RK30S	30.0	61.0	2.8	3.47	13.5	> 1700	1.2	25		所有熔窑: 烧嘴砖, 观察孔, 烟道进口 保温棉玻璃炉: 上部结构, 大碓 波拉: 衬砌	All furnaces: Burner block, peephole block, flue gas channel entrance, Fiberglass furnace: Superstructure, crown Coupola furnace: Lining
DURITAL RK50NP	DURITAL RK50NP	52.0	39.0	3.2	3.80	15.2	> 1700	1.2	30		所有熔窑: 贴补用砖	All furnaces: Overcoating tiles
DURITAL RK50S	DURITAL RK50S	51.5	38.5	3.8	3.78	13.8	> 1700	1.2	15		保温棉玻璃炉: 烟道进口 波拉: 衬砌	Fiberglass furnace: Flue gas channel entrance, Coupola furnace: Lining
SUPRAL RK30S	SUPRAL RK30S	30.8	61.5	2.7	3.45	16.0	> 1700	1.2	25		彩色玻璃: 挂钩砖 保温棉玻璃炉: 池壁, 底部	Colour glass furnace: Tuck stones Fiberglass furnace: Side wall, melter bottom
SUPRAL RK50S	SUPRAL RK50S	53.0	37.0	4.4	3.77	14.2	> 1700	1.2	25		所有熔窑: 加料端拐角 保温棉玻璃炉: 池壁, 流液洞	All furnaces: Doghouse corners Fiberglass furnace: Side wall, throat
SUPRAL RK55S	SUPRAL RK55S	52.0	42.0	2.6	3.80	15.3	1700	1.2	25		所有熔窑: 加料端拐角 彩色玻璃: 池壁, 流液洞 保温棉玻璃炉: 池壁, 流液洞	All furnaces: Doghouse corners Colour glass furnace: Wall, throat Fiberglass furnace: Side wall, throat
SUPRAL RK70	SUPRAL RK70	73.7	14.5	3.8	3.80	18.0	1700	1.1	15		保温棉玻璃炉: 加料端拐角, 流液洞	Fiberglass furnace: Doghouse corners, throat
ANKOFORM RK30ZF-6-DE	ANKOFORM RK30ZF-6-DE	30.5	62.0	1.9	3.32	19.0	> 1700	0.8 (1000 °C)	13		保温棉玻璃炉: 通道流槽及通道盖板	Fiberglass furnace: Feeder channel and feeder cover
ANKOFORM RK55ZF-6-DE	ANKOFORM RK55ZF-6-DE	55.0	31.0	5.0	3.44	21.0	1700	0.8 (1100 °C)	7		保温棉玻璃炉: 通道流槽及通道盖板	Fiberglass furnace: Feeder channel and feeder cover

Cycles / 周期

Grade / 牌号

New name / 新名称

Old name / 旧名称

AP 显气孔率 / Apparent porosity

BD 体积密度 / Bulk density

RUL 荷重软化温度 / Refractoriness under load

TE 热膨胀 / Thermal expansion

TSR 抗热震性 / Thermal shock resistance



三年后DURITAL RK30NP外部贴砖 /
DURITAL RK30NP overcoating tiles after three years



重建玻璃纤维熔炉铬刚玉流液洞 /
Chrome corundum throat area in a rebuilt fiber glass furnace

应用实例

可在全腐蚀侧壁上安装DURITAL RK30NP 外部贴砖, 包括横火焰玻璃池窑的电极砖。安装完成后, 贴砖可立即与玻璃接触。确保在安装过程中外部贴砖不会破裂。在玻璃池窑运行三年后关闭, 会发现液面线区域若干点位的最大腐蚀深度可达到50毫米, 而使用铬刚玉外部贴砖的客户不会在玻璃上发现任何变色现象。

Application example

DURITAL RK30NP overcoating tiles were positioned in a completely corroded sidewall including electrode blocks in a cross-fired container glass tank. The tiles were in glass contact immediately after installation. No cracking occurred during installation. After three years in operation the tank was shut down. Maximum corrosion was 50 mm at a few spots in the flux line. Customers working with chrome corundum overcoating tiles have never observed any coloring effect on the glass.

振动浇注产品

为采用铬刚玉材料制作大尺寸或复杂几何形状耐火砖，本公司已经开发了两种振动浇注产品。将混合物倒入模具中，随后在振台上压实。待混合物固化后，从模具中取出浇注块，小心干燥并采用合适温度烧结浇注块。ANKOFORM RK3OZF-6-DE和ANKOFORM RK55ZF-6-DE分别含有30%和55%的氧化铬，不仅具有压制耐火砖产品的优点，还可以生产重达1吨的超大耐火砖。在特殊应用中，甚至可以制作重量超过1吨的耐火砖。

振动浇注产品特别适用于饲槽区域，因为可以减少料槽区域的接缝数量，从而降低潜在玻璃缺陷。料槽盖有时非常复杂，并且尺寸较大。采用振动浇注技术，可以实现料槽盖一体化生产。

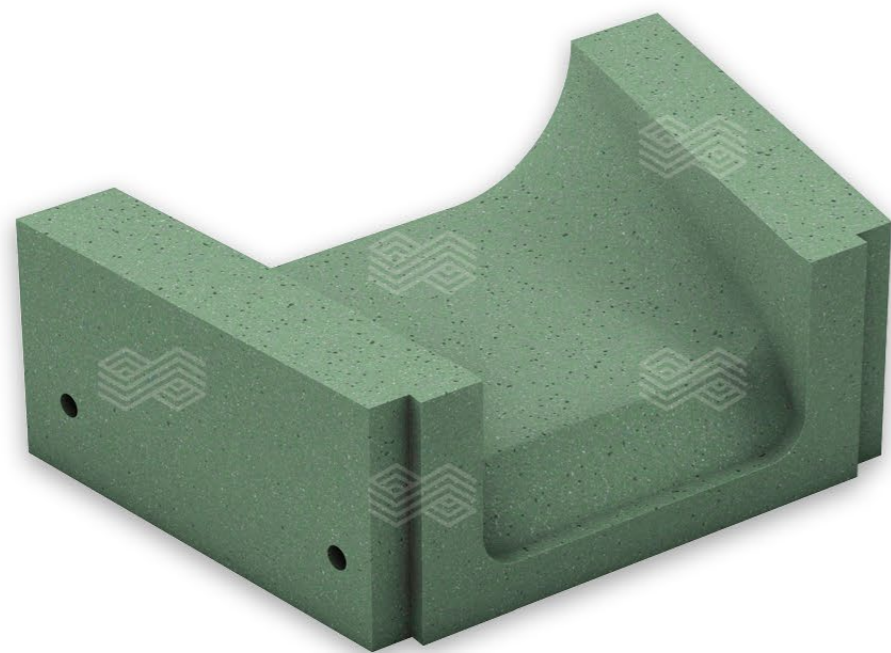
RHI Magnesita的振动浇注铬刚玉制品具有优异的热性能。

Vibrocast Products

To realize large-size blocks or complex geometries from chrome corundum material, two products have been developed, which are produced by vibrocasting. This includes the pouring of a mix into molds with subsequent compacting on a vibration table. After setting, the blocks are removed from the mold, carefully dried and sintered with an adapted temperature program. ANKOFORM RK3OZF-6-DE and ANKOFORM RK55ZF-6-DE with chromium oxide contents of 30 and 55%, respectively, show the advantages of pressed varieties, but allow the production of very large components up to a weight of one ton. For special applications even formats weighing well over one ton are possible.

The vibrocast products are of particular interest in the feeder area. Cast feeder channel elements enable the reduction of joints, which are potential sources of glass defect in this area. Feeder covers are sometimes quite complex and also large. With the vibrocast technology, they can be produced in one piece.

Vibrocast chrome corundum products made by RHI Magnesita exhibit excellent hot properties.



以客户为导向-系统方案 — 耐火材料回收

回收氧化铬

对于钠钙玻璃熔炉的某些特定区域，特别是玻璃纤维生产工艺熔炉，含氧化铬的耐火砖是最佳耐火材料。

应按照法律规定处置玻璃熔炉中报废的氧化铬耐火材料，即使大部分材料的铬含量远低于法定允许水平。

为帮助客户处置氧化铬耐火材料，RHI Magnesita提供高度灵活铬刚玉耐火材料回收服务，包括在生产过程中运输、处理、重装或正确处置铬刚玉耐火材料。可处理并回收有用材料用作生产辅料。RHI Magnesita拥有丰富的铬刚玉产品系列，其中部分产品采用再生材料制成。

Customer-oriented System Solutions — Refractory Recycling

Recycling of chromium oxide

In some specific areas of soda-lime glass-melting tanks and especially for the production of fiberglass, refractory bricks containing chromium oxide are the best material.

Chromium oxide refractories scrapped from glass tanks are subject to legal restrictions, even if most of the material is far below the legally permissible chrome-VI limit.

In order to support our customers with the disposal of such materials, RHI Magnesita offers a highly flexible concept for taking back chrome corundum refractory materials. This service includes the transport, treatment and renewed inclusion of the material in the production process or its correct disposal. Usable material is treated and recycled in production as a secondary raw material. RHI Magnesita has a broad product line of chrome corundum grades, which are partially also made of recycled material.



Content



Bricks



Grades



Solutions

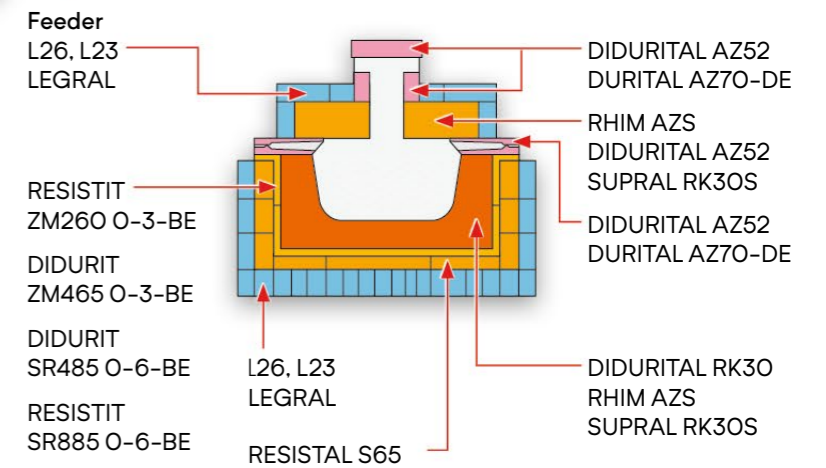
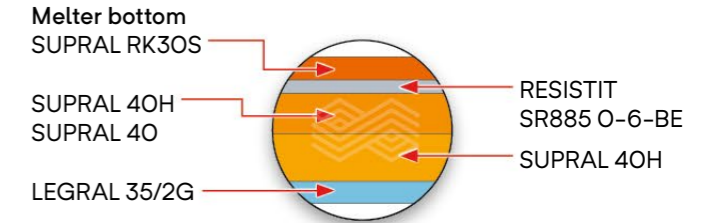
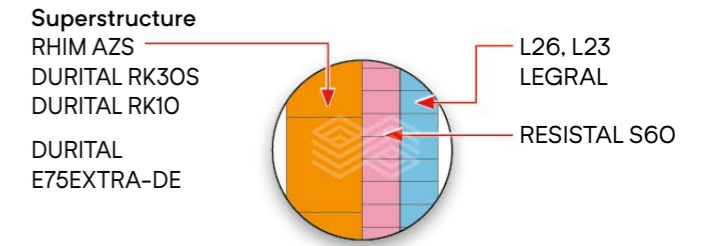
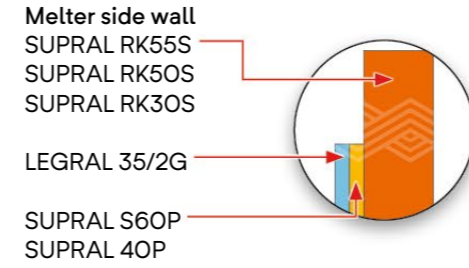
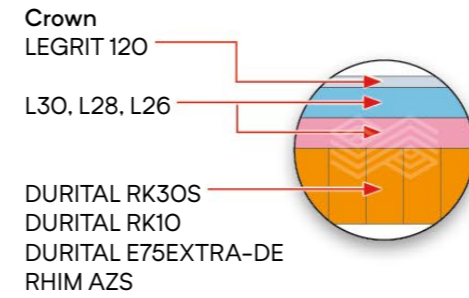
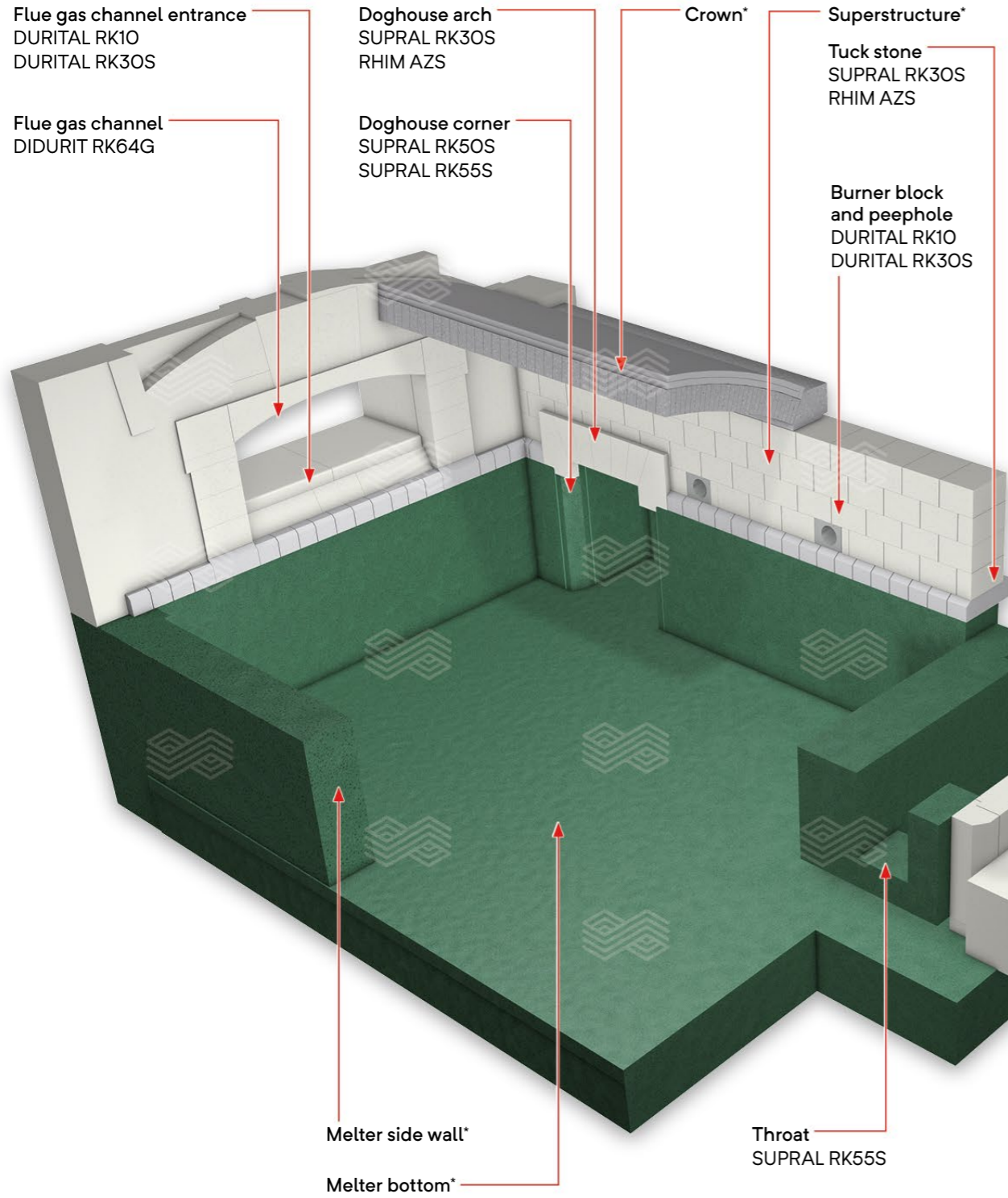


Lining



玻璃纤维窑

Fiberglass Tank



- Burner block and peephole / 喷嘴砖和观察孔
- Crown / 窑顶
- Doghouse arch / 投料口穹
- Doghouse corner / 投料口拐角
- Feeder / 料槽
- Flue gas channel / 烟气通道
- Flue gas channel entrance / 烟气通道入口
- Melter bottom / 熔窑池底
- Melter side wall / 熔窑池壁
- Superstructure / 上部结构
- Throat / 流液洞
- Tuck stone / 挂钩砖

* 见右页配置详图 / Detailed lining on right page

Imprint:

Media owner and publisher: RHI Magnesita N.V., Branch Vienna, Kranichberggasse 6, 1120 Vienna, Austria

Produced by: RHI Magnesita — 04 / 2021-CN/EN

Place of publication and production: Vienna, Austria



Copyright notice:

The texts, photographs and graphic design contained in this publication are protected by copyright. Unless indicated otherwise, the related rights of use, especially the rights of reproduction, dissemination, provision and editing, are held exclusively by RHI Magnesita. Usage of this publication shall only be permitted for personal information purposes. Any type of use going beyond that, especially reproduction, editing, other usage or commercial use is subject to explicit prior written approval by RHI Magnesita.



奥镁（中国）有限公司

中国 上海市淮海中路222号力宝广场2208-2211室，邮编：200021

电话：+86 21 2319 9513 传真：+86 21 6391 5270

E sha_sales@rhimaginesita.com

RHI Magnesita (China) Co.,Ltd

Rm.2208-2211 Lippo Plaza, No.222 Huaihai (M) Rd, Shanghai, 200021 China

T +86 21 2319 9513 F +86 21 6391 5270

E sha_sales@rhimaginesita.com

RHI Magnesita GmbH

Klingholzstraße 7, 65189 Wiesbaden, Germany

T +49 611 7335 300

E glass@rhimaginesita.com

rhimaginesita.com

The Journal of
Refractory Innovations

bulletin

Subscriptions
Service and
Contributions

