smartmelter

Furnace Life Optimization Solution

Refractory Thickness Sensor (RTS)

耐材厚度探测传感器（RTS）

Blind Trial at a Container Glass Furnace

在瓶罐玻璃炉上的盲试

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paneratech

CONTENT
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INTRODUCTION
介　　绍

International Partners in Glass Research (IPGR) approached PaneraTech to demonstrate accuracy of the SmartMelter Refractory Thickness Sensor (RTS) at a blind trial with one of its members. IPGR members include major regional container glass manufacturers such as Sisecam, Vidrala, Fevisa, Gallo, Vetropack, Wiegand-glas, Bangkok Glass, Nihon Yamamura and Orora Limited. Among the members, Vidrala had a furnace in their plant in Marinha de Grande, Portugal that was scheduled for cold repair. The furnace was 13.5 years old.

国际玻璃研究合作协会(IPGR)接触到PaneraTech帕尼罗科技并愿意在其中一协会成员中开展对SmartMelter智慧窑炉耐火砖壁厚探测传感器（RTS）的精确度盲试实验。IPGR成员包括主要的区域瓶罐玻璃制造商如Sisecam,Vidrala,Fevisa,Gallo, Vetropack,Wiegand-glas,Bangkok Glass,Nihon Yamamura以及Orora Limited。在这些成员中, Vidrala在葡萄牙Grande码头有一座已经运行13.5年的窑炉计划冷修。

SmartMelter RTS measurements were performed five days before the furnace drain. PaneraTech submitted a report of the measured wall thicknesses to Vidrala prior to the drain, and then the furnace was drained and blocks were recovered to compare the RTS measurements with actual wall thicknesses at the glass line.

SmartMelter智慧窑炉RTS在窑炉放水前5天进行了探测。PeneraTech帕尼罗科技向Vidrala在窑炉放水前提交了所有池壁砖厚度探测结果的报告，在窑炉放水后池壁砖被复原实测并与RTS探测的池壁砖液位线处厚度结果对比。

Figure 1
Trial Team: Representatives from Vidrala (Diego Ochoa Escalona, Vidrala Corporate Furnace Production Manager, Pedro Andrade, Vidrala Plant Batch and Furnace Manager, Andre Grilo furnace operator) and PaneraTech (Yakup Bayram CEO and Alex Ruege, Principal Engineer)

图　1
测试实验团队：Vidrala的代表(窑炉生产经理Diego Ochoa Escalona,配料与窑炉经理Pedro Andrade,及窑炉操作员Andre Grilo）和PeneraTech帕尼罗科技人员(CEOYakup Bayram以及总工程师 Alex Ruege）

MEASUREMENT SPOTS
测　量　点

The Vidrala furnace was an end port-fired furnace. Measurements were taken at two spots near the left doghouse, two spots on the left sidewall, and three spots on the right sidewall. There were also four spots measured in between the two throats. Altogether, eleven areas of the furnace were measured by the RTS sensor.

Vidrala 窑炉是端焰窑，测量点选定在左侧加料口的两个点，及左侧侧壁处两个点以及右侧池壁的三个点。另外有四个点选在两个流液洞之间，窑炉一共有七个点被选择用RTS传感器进行探测。

Figure 2
Furnace Layout and Measurement Spots

图　2
窑炉布局及测量点

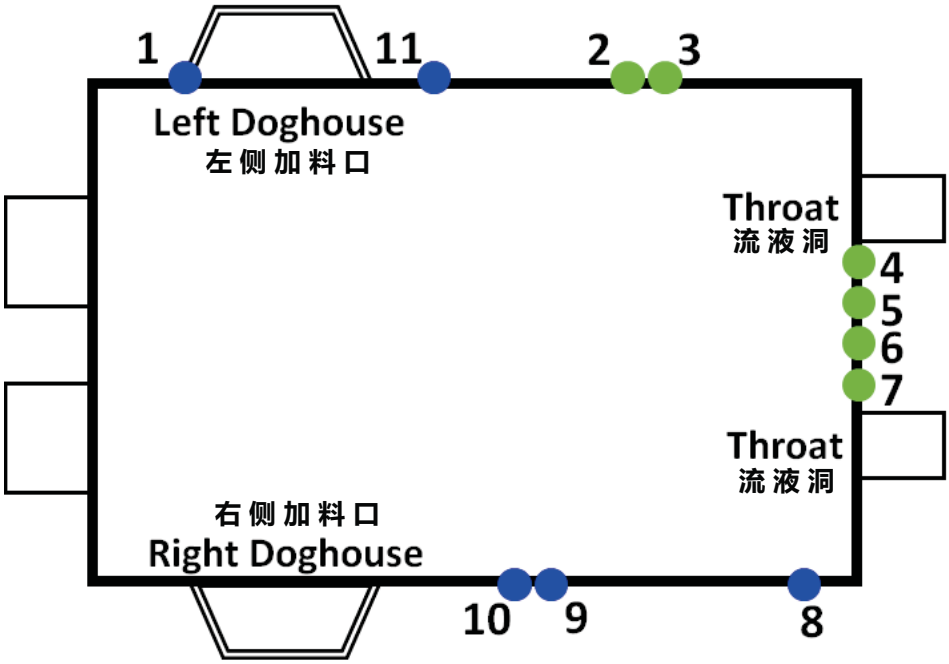

Figure 3
Each measurement spot was marked properly

图　3
每个测量点均被正确恰当标记

WALL STRUCTURE AND MEASUREMENTS
池壁结构及测量

The measurements were taken with the RTS sensor through fused-cast AZS overcoat blocks (32% AZS) at the metal line. The configuration of the blocks and the measurement process is shown in Figure 4. The PaneraTech team measured through the overcoat blocks at locations shown in Figure 3. Gratings that were holding the overcoat blocks in place were cut prior to measurements to allow for access to the exposed AZS (see Figure 3) .

测量是通过RTS传感器在池壁液位线处通过AZS贴砖(32%AZS)来进行的，图4表示了池壁结构及探测的过程。PaneraTech帕尼罗科技的团队对图3位置的池壁的贴砖进行了探测，固定贴砖的金属格栅已经被提前切割取掉以便探测传感器可以接触到AZS耐火砖 (如图3所示）。

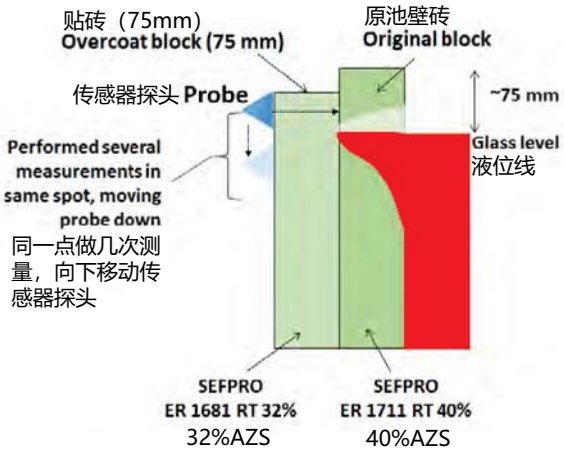

Figure 4
Wall layout at Vidrala furnace

The RTS sensor thickness profile is a vertical scan. It starts about 45 mm (1.7 in) from the very top of the overcoat block to 100 mm (4 in) where the glass line was expected .

RTS探测传感器的厚度方向截面是向纵深处垂直扫描。从贴砖的最上沿的45mm(1.7英寸)处向下直到100mm(4英寸)处是液位线的范围。

Figure 5
PaneraTech team member taking measurements on the furnace

图 5
PaneraTech 帕尼罗科技团队人员在对窑炉进行探测

THE RESULTS

After the drain, five blocks were successfully recovered. The other blocks could not be recovered due to the limitation by the construction schedule at the factory. The RTS measurement and actual thickness of one of the spots measured is shown in Figure 6.

在窑炉放水后，有5块耐火砖被复原，其它的砖由于工厂冷修建造计划的限制，RTS探测传感器测量数据与其中一个点的实测耐火砖的厚度对比结果如图6所示。

These actual block thickness were measured with Vidrala team as seen in Figure 7.

由Vidrala团队人员实测的实际耐火砖厚度数据见图7所示。

The recovery of the blocks shortly after the furnace drain revealed that the glass was in direct contact with the overcoat block in these areas

在窑炉放水后很快就对测点的耐火砖进行了复原，这些地方玻璃液已经直接侵蚀并接触到贴砖了。

The original tank block had completely eroded at the glass level at the measurement spots. The RTS measurements taken from the probe corresponded with the actual erosion profile found in the recovered blocks. The RTS sensor successfully measured the thickness of the residual AZS at the glass line for these five spots within 4 mm (0.15 inch) accuracy as shown in Table I

在测点附近液位线处原池壁砖已经完全被完全侵蚀掉，RTS 传感器探测到的数据与实测的被复原的耐火砖侵蚀剖面完全一致，RTS传感器成功地探测到了这5个点的AZS耐火砖液位线处的残余实际厚度，精确度误差在4mm(0.15英寸)之内，如表1所示。

Figure 6
Comparison of actual block thickness (69 mm) with RTS sensor measured thickness (67 mm) at Spot # 6

图 6
使用RTS传感器对测点#6探测的厚度(67mm)与实测耐火砖厚度(69mm)对比

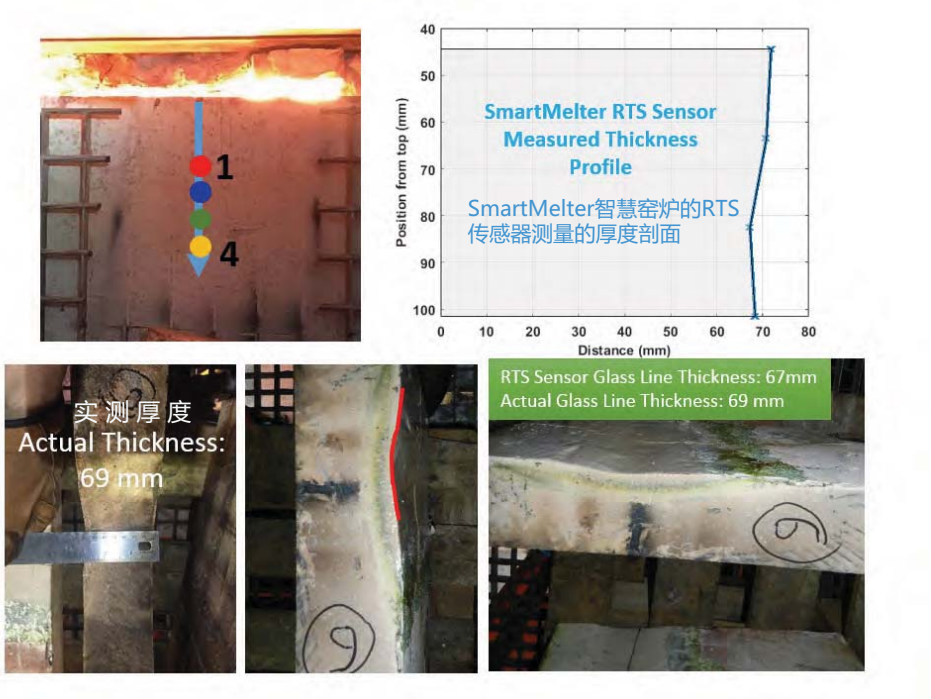

Figure 7
Vidrala and PaneraTech team measuring actual wall thickness after the recovery of the blocks.

图 7
Vidrala和 PaneraTech 团队人员在复原耐火砖后对壁厚进行实测

Spot Number 测 点 编 号	SmartMelter RTS Sensor Reading 传 感 器 读 数	Actual AZS Block Thickness 实测AZS耐火砖厚度	Difference 误差
2	73 mm	73 mm	0 mm
3	75 mm	71 mm	4 mm
5	65 mm	69 mm	4 mm
6	67 mm	69 mm	2 mm
7	63 mm	67 mm	4 mm

Table 1
Comparison of Actual Block Thickness with RTS Sensor Measurements

表 1
RTS传感器探测数据与实测壁厚对比

This blind trial clearly demonstrated the accuracy of the RTS sensor for measuring fused-cast AZS thickness on an operational container glass furnaces.

本次盲试实验清楚地表明了RTS传感器在运行的瓶罐玻璃炉上探测电熔AZS耐火砖厚度的精确性。

CONCLUSION
结 论

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