

Refractory Thickness Sensor (RTS)
耐火砖厚度探测传感器 (RTS)

Blind Trial at a Float Line
浮法线盲试

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PaneraTech was approached by a leading global float glass manufacturer to demonstrate our Refractory Thickness Sensor (RTS) measuring residual fused-cast AZS thickness on a float line furnace

PaneraTech帕尼罗科技在一家全球领先的浮法玻璃制造商的支持下在一座浮法玻璃窑炉上进行了耐材厚度探测传感器 (RTS) 对电熔AZS砖的盲试验证。

The manufacturer chose a float furnace that was based in Europe. The blind trial date for the furnace was scheduled to be performed in time for hot repair. SmartMelter RTS measurements were performed about one week before the hot repair

这家玻璃制造商选择了一座位于欧洲的浮法窑炉，盲试验证的日期计划定于窑炉热修前进行，SmartMelter的耐材厚度探测传感器在热修前一周进行了厚度探测。

PaneraTech submitted a report of the measured fused-cast AZS thickness to the float manufacturer prior to the hot repair. The glass manufacturer then lowered the glass level to a safe level and recovered the blocks during the hot repair. The glass manufacturer later measured the actual fused-cast AZS block thicknesses at the measurement spots and compared the measurements with PaneraTech's RTS sensor readings. The overall results demonstrated that PaneraTech's RTS sensor had measured wall thickness within 0 -5mm (0.2inch) of the actual block thickness.

PaneraTech帕尼罗科技在窑炉热修前向浮法玻璃制造商提交了对电熔AZS耐火砖厚度探测的报告，这个玻璃制造商在降低玻璃液位至安全高度后在热修期间取出并复原了一些耐火砖，他们随后对取出的电熔AZS耐火砖在相应的探测点进行了实际测量，与PaneraTech帕尼罗科技的RTS探测传感器的测量结果进行对比，探测结果显示与实测误差在0-5mm (0.2英寸)。

INTRODUCTION 介绍



Figure 1
Trial Team: Representatives from Float Glass Manufacturer and PaneraTech (Yakup Bayram CEO and Alex Ruege, Principal Engineer)

图示 1
盲试验证团队：浮法玻璃制造商代表及PaneraTech帕尼罗科技(CEO Yakup Bayram, 总工程师Alex Ruege)



MEASUREMENT SPOTS 测量点

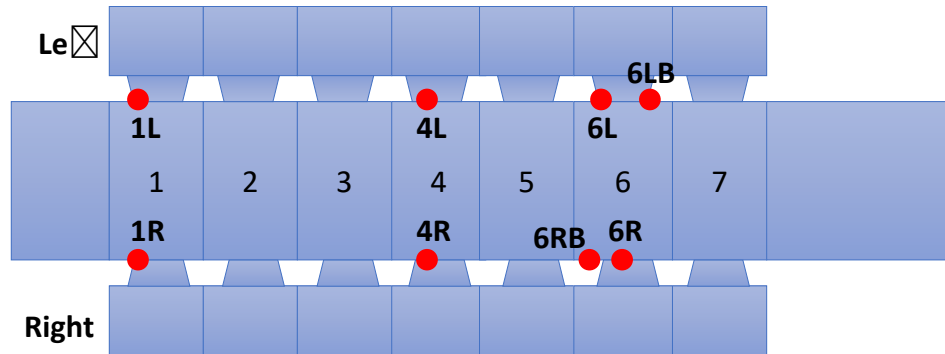
The float line furnace was a cross-fired furnace. Measurements were taken on a total of 8 blocks (see Figure 2) at both left and right side of ports 1, 4 and 6

这座浮法线为横火焰窑炉，测量点选择在1, 4和6号小炉的左右两侧的共8块耐火砖处(见图2示)

Figure 2
Furnace Layout and Measurement Spots

图 2

窑炉布局及测量点分布



WALL STRUCTURE AND MEASUREMENTS 池壁结构及测量

The overcoat blocks were supported by a horizontal metal bar in the middle. The measurements were taken with the RTS sensor through fused-cast AZS overcoat blocks (32% AZS) at the metal line (above the metal bar in the middle) and also below the metal bar (see Figure 3). The configuration of the blocks and the measurement process is shown in Figure 3. Depending on the location at the port, the overcoat blocks had thicknesses ranging from 50 mm (2in) to 75 mm (3 in) . In some locations, there were multiple overcoat blocks.

贴砖由水平向横在中间的金属栏所支撑，使用耐材厚度探测传感器RTS对液位线处的AZS贴砖(32%AZS)进行测量(在中间金属栏的上方) 以及金属栏的下方(如图示3),图3为测量过程及砖的位置示意。根据小炉的位置的不同其池壁贴砖的厚度也从50 mm(2英寸)到75mm(3英寸)不等，在某些位置还存在多层贴砖的情况。

Figure 3
Wall Layout at Float Furnace

图 3

浮法窑炉池壁贴砖结构布局

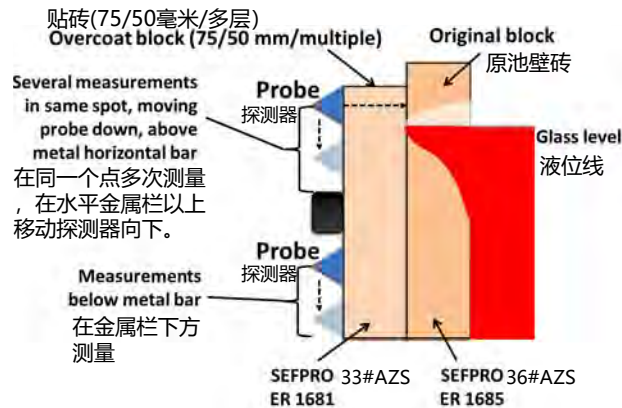




Figure 4
Each measurement spot was marked properly

图 4

每个测量点被正确标记

Gratings that were holding the overcoat blocks in place were cut prior to the measurements to allow access to the exposed AZS as shown in Figure 4.

图4所示,保持贴砖的格栅在测量前已经被提前切割以便传感器接触到裸露的AZS砖面。

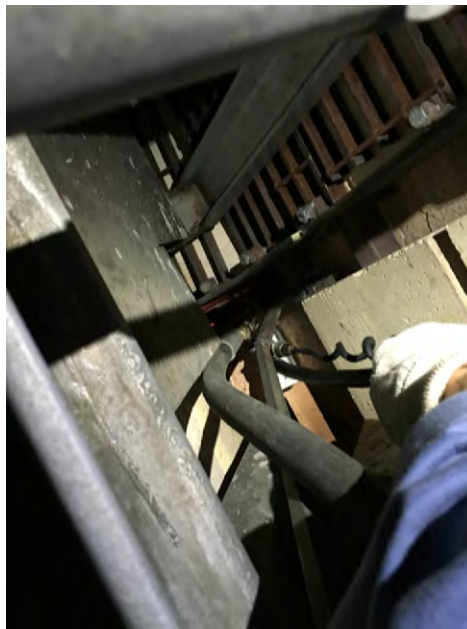


Figure 5
PaneraTech team member taking measurements on the furnace

图 5

PaneraTech帕尼罗科技的团队在窑炉上做测量

THE RESULTS

After lowering the glass level, all of the blocks were successfully recovered. The actual thickness of each block was measured with the float line manufacturer team. The original tank block had completely eroded at the glass level for most of the blocks.

在降低玻璃液位以后，所有的耐火砖被成功复原，浮法玻璃线的人员对每块砖实际的残余厚度进行了测量，液位线处的几乎所有原池壁砖被完全侵蚀掉了。

The RTS sensor successfully measured the thickness of the residual AZS for these five spots within 0-5 mm (0.2 inch) accuracy as shown in Table 1
耐火砖厚度探测传感器RTS成功地探测了这些5个点的AZS耐火砖的残余厚度且与实际测量对比误差仅0-5mm(0.2英寸)的精度，如表1所示。

Figure 6
Pictures of Some of the Blocks
Recovered During Hot Repair

图 6

热修后复原的一些耐火砖图片



Spot Number 位置点编号	SmartMelter RTS Sensor Reading RTS探测传感器读数	Actual AZS Block Thickness AZS耐火砖实测厚度	Difference 误差值
1L Top (Glass Line)	73 mm	75 mm	2 mm
1L Bottom	75 mm	75 mm	0 mm
1R Top (Glass Line)	75 mm	75 mm	0 mm
1R Bottom	75 mm	75 mm	0 mm
4L Top (Glass Line)	36 mm	39 mm	3 mm
4L Bottom	50 mm	50 mm	0 mm
4R Top (Glass Line)	34 mm	35 mm	1 mm
4R Bottom	49 mm	50 mm	1 mm
6L Top (Glass Line)	59 mm	64 mm	5 mm
6L Bottom	75 mm	74 mm	1 mm
6LB Top (Glass Line)	68 mm	72 mm	4 mm
6LB Bottom	74 mm	74 mm	0 mm
6R Top (Glass Line)	64 mm	66 mm	2 mm
6R Bottom	73 mm	72 mm	1 mm
6RB Top (Glass Line)	58 mm	62 mm	4 mm
6RB Bottom	75 mm	75 mm	0 mm

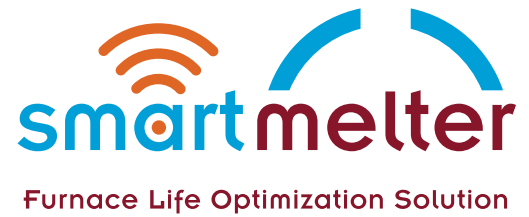
Table 1
Comparison of Actual Block
Thickness with RTS Sensor
Measurements

表 1
RTS探测传感器所测读数与
实测砖厚对比表

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

这次盲试探测清晰地描述了RTS探测传感器测量电熔AZS耐火砖地厚度在运行的玻璃窑炉浮法线上的准确精度。

CONCLUSION 结 论



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