smartmelter

Furnace Life Optimization Solution

Furnance Bottom Thickness
窑炉池底厚度

Blind Trial at a Float Line
浮法线 盲试

smartmelter.com

PT
paneratech

CONTENT

INTRODUCTION
介　　绍

A major US-based float glass manufacturer approached PaneraTech to use our SmartMelter solution to measure the residual thickness of the furnace bottom on a float line furnace. The float furnace was near the end of the campaign, and the health of the bottom was of great concern for the manufacturer. Eight months before the planned shutdown date, PaneraTech performed an initial assessment of the furnace bottom. PaneraTech performed several surveys leading up to the planned shut-down to map the residual thickness of the furnace bottom

一个美国的主要浮法玻璃制造商联系PeneraTech帕尼罗科技希望利用SmartMelter技术来探测浮法线窑炉底部的残余厚度, 这个窑炉已经接近于窑龄后期, 这个制造商对窑底的情况非常关注。就在停炉计划日的前8个月, PeneraTech帕尼罗科技对这个窑炉底部进行了探测并初步评估,绘制窑底残余厚度调查以导致计划停炉的原因。

The objective of this monitoring program was to monitor the progress of glass infiltration at the furnace bottom. Prior to the furnace drain for rebuild, PaneraTech performed a final survey of the furnace bottom using the SmartMelter sensors. After this final survey, PaneraTech submitted a report indicating the final thicknesses of the furnace bottom that was mapped over a large area.

这个探测项目的主要任务是监控窑炉底部被玻璃液渗透的过程，在窑炉放料及冷修之前，PaneraTech帕尼罗科技使用SmartMelter传感器对窑底进行了最终查勘。在最终查勘后，PaneraTech帕尼罗科技提交了对窑底大面积区域的厚度探测报告。

After the drain, the float glass team selected several spots and measured the actual physical thicknesses of the bottom. This was compared with the SmartMelter measurements. The overall results demonstrated that the SmartMelter solution had measured residual bottom thickness within 0 - 5mm (0.2 inch) of the actual bottom thickness.

在窑炉放水后, 浮法玻璃线方面在池底选取了几个点并做了实际的厚度测量用来与SmartMelter探测的厚度数据比较，最终结果显示利用SmartMelter技术探测的厚度与实际测量的池底厚度相差在0-5mm(0.2英寸)范围之内。

Figure 1
SmartMelter Furnace Bottom Inspection at a Float Line

图　1
SmartMelter在浮法窑底的探测

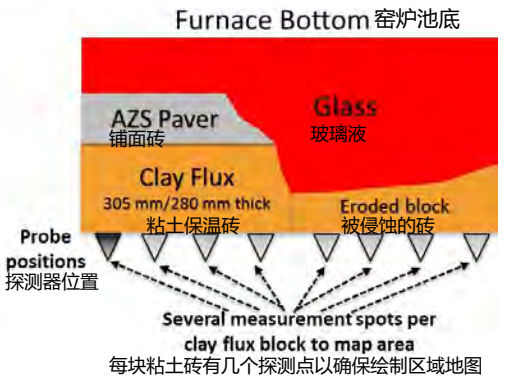
BOTTOM STRUCTURE AND MEASUREMENT
池底结构及测量

The measurements were performed on the bottom of the float line manufacturing furnace in the refiner area. The measurements were done in one day and covered 49 blocks-an area of 28 m² (300 ft²). Each block was 305 mm (12 in) in original thickness, except for the last three rows of the furnace, which were 280 mm (11 in) in original thickness. The cross section of the bottom layout over two clay flux blocks is shown in Figure 2. As shown, several measurements were taken using the SmartMelter sensors to cover the whole block. Using this data acquired from SmartMelter, a three-dimensional map of the refiner bottom was created, indicating glass penetration into the clay flux and showing residual thickness.

探测在浮法玻璃窑炉的澄清区的底部进行，对共计49块池底砖28平方米(300平方英尺)的区域探测持续了一天时间。除了最后三排的砖原厚为280mm(11英寸),其它每块砖的原始厚度为305mm(12英寸), 池底的保温粘土层的局部横截面如下图2所示，使用SmartMleter探测传感器覆盖整个砖进行探测，最后利用探测的数据建立了整个窑底澄清区域的三维可视地图，用以显示玻璃液渗透入保温粘土层的情况及其残余厚度。

Figure 2
Furnace Bottom Layout and Measurement Spots

图 2
窑炉池底结构 布局及测量点



THREE DIMENSIONAL VIEW AND MEASUREMENT
三维可视化及测量

Before the drain, the data was obtained so that a 3-D view of the erosion profile on the furnace bottom could be created. A top view of this profile is shown in Figure 3. Five locations were measured for comparison and are marked in the figure. Note that the erosion profile indicates a minimum residual thickness of 99 mm (3.9 in) near spot 1. The blocks in this area show strong erosion, where the original thickness of the block was 280 mm (11 in). A photograph of this same area, highlighted in red, is shown in Figure 4. It is clear from the photograph that the areas of clay flux penetration correspond to the areas indicated in the 3-D erosion view.

在窑炉放水前，利用收集到的探测数据创建了一个三维可视化的窑底侵蚀地图，图3是侵蚀地图的顶视，其中有5个位置的实测数据与图中对应的位置的数据进行了对比。请注意在测点1附近的侵蚀轮廓显示最小的残余厚度仅剩99mm(3.9英寸),这个区域的砖有严重的侵蚀, 其粘土底砖的原始厚度为280mm(11英寸)。在同一区域的照片中如图4所示红框范围内的被玻璃液穿透的情况与三维侵蚀图显示是一致的。

The perspective view of this erosion is shown in Figure 5. For the physical comparison after the drain, any residual glass remaining was removed from the top of the blocks.Then the spots were drilled and measured.(see Figure 6)

图5所示为窑底侵蚀地图的透视，窑炉放水后的实测是将耐火砖上表的所有残余玻璃去除后对所标定测点进行钻孔和测量所得的数据。(如图6所示)

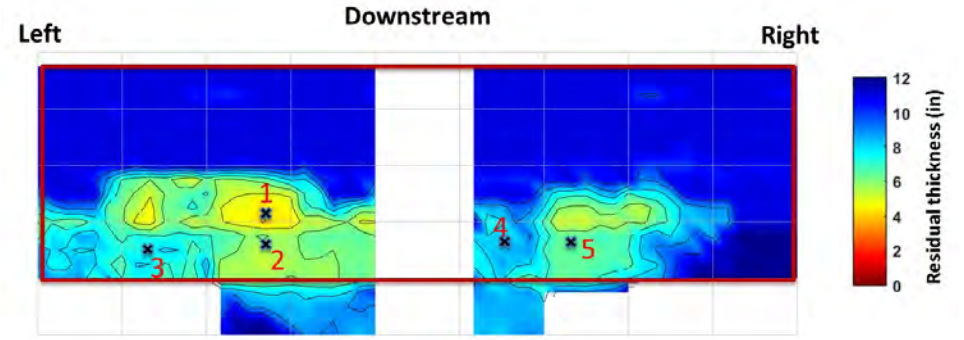


Figure 3
Top view of clay flux erosion obtained before furnace drain

图 3
窑炉放水前池底粘土保温砖侵蚀图顶视

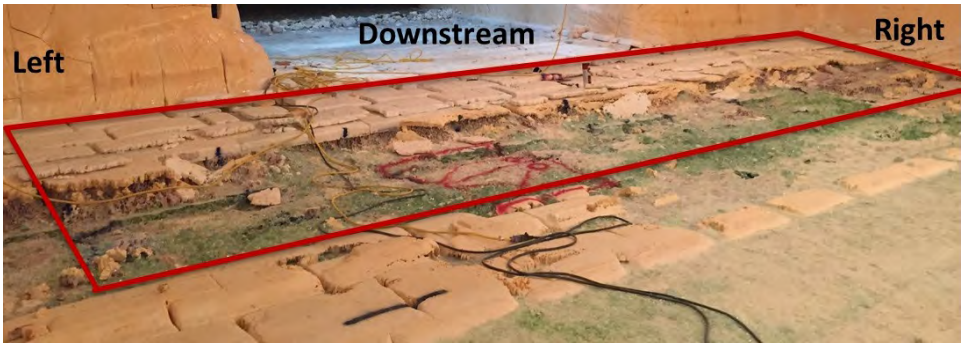


Figure 4
Post-drain photograph of area under inspection (red)

图 4
被检测区域（红框内）窑炉放水后照片

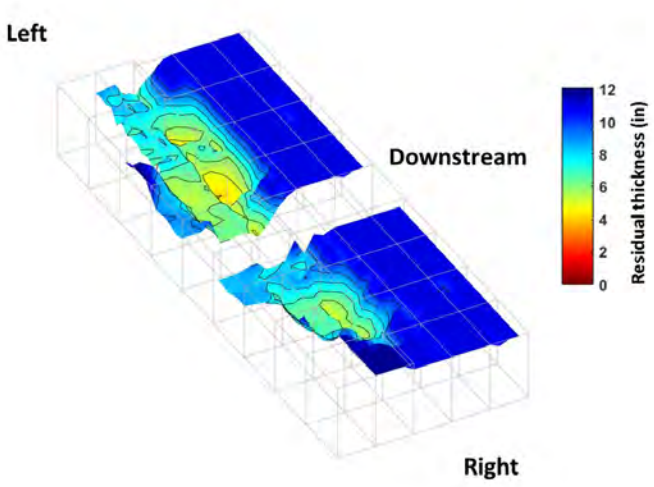


Figure 5
SmartMelter 3D visualization of furnace bottom at the refiner area before furnace drain

图 5
在窑炉放水前的SmartMelter 3D可视化窑底澄清部侵蚀地图

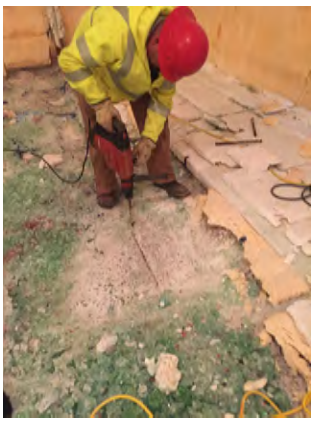
THE RESULTS
结　　果

After the drain, several spots were chosen by the float glass manufacturer for comparison with the SmartMelter results. The remaining cold glass was removed and these spots were drilled. The actual thickness of each block was measured by the float line manufacturer team. In the spots that were examined, the original AZS paver blocks had eroded and glass had penetrated into the clay flux. The SmartMelter sensor successfully measured the thickness of the residual clay flux for these five spots within 0 - 5 mm (0.2 inch) accuracy as shown in Table 1. The five blocks had residual thicknesses of 99 mm to 208 mm .

在窑炉放水后，浮法玻璃制造商选择了几个点实测来与SmartMelter的探测结果对比，这几个点上的残余冷玻璃被去除并钻孔实测，每块被钻孔的砖的实际厚度被浮法玻璃制造商的人员测量验证，在这些测点商原有的AZS铺面砖已经被玻璃液完全侵蚀并且玻璃液穿透到粘土保温层中。SmartMelter的探测传感器成功地探测到了这5个测点保温层粘土砖残余厚度，与实测对比精度达到0-5mm(0.2英寸）如表1所示，5个测点的砖的残余厚度测得为99mm至208mm。

Figure 6
Validation of SmartMelter with glass removal, drilling and measurement of actual thickness

图　6
SmartMelter验证，通过与去除玻璃，钻孔后的实测厚度数据对比



Block Number 砖　　号	SmartMelter Sensor Reading 探测传感器读数	Actual Clay Flux Block Thickness 实测粘土砖厚度	Difference 差　值
1	99 mm	102 mm	-3 mm
2	140 mm	140 mm	0 mm
3	203 mm	203 mm	0 mm
4	208 mm	203 mm	-5 mm
5	163 mm	165 mm	-2 mm

Table 1
Comparison of Actual Block Thickness with SmartMelter Measurements

表　1
SmartMelter探测与实测数据对比

CONCLUSION
结　　论

This blind trial clearly demonstrated the accuracy of the SmartMelter system for measuring furnace bottom thickness. The trial also facilitated a safe shutdown for the float line manufacture with a drain that occurred according to schedule.

本次盲试检测清楚地验证了SmartMelter系统的对窑炉池底厚度的探测精度，同时也推进了一座浮法线窑炉有计划的通过放水安全地停炉维修。

smartmelter

Furnace Life Optimization Solution

smartmelter.com

PaneraTech, Inc.

帕尼罗科技公司

info@smartmelter.com

P +1 703.719.9666

4125 Lafayette Center Drive, Ste 200, Chantilly, VA 20151 USA

美国弗吉尼亚州拉斐特中心大道4125号尚蒂利200室 邮编20151

PT paneratech