SAPOTECH

Reveal TAP Tuyere area monitoring

Description

In stainless steel production, converter processes are used to refine the composition of the melt. In ferrochrome converter, silicon and part of the carbon is removed from molten ferrochrome by blowing oxygen into the melt. In AOD the carbon content is further decreased and oxidized alloying elements are reduced back to the steel bath. Because of the thermal, mechanical, and chemical stresses, the refractories and tuyeres experience constant erosion and material build-ups, which can affect the process behavior and can also lead to steel break-out. The evaluation of the tuyere area condition is usually made by the operators from the sampling hole. This approach has many drawbacks, which are covered with Sapotech solution.

Application

To systematize the tuyere area condition monitoring, Sapotech has developed a system that images the tuyere area nozzles and the surrounding refractories after the converter has been tilted to the sampling position. The industrial camera, mounted into a linear actuator moves from the protective enclosure to the sampling hole and takes images from the tuyere area. The imaging sequence takes around 20 seconds. Images are processed with Deep Neural Network-based model and with traditional image processing algorithms to extract information about:

1. Position of the nozzle tips and the nozzle bases.
2. Refractory wear around the tuyeres.

Videos and measurement results are displayed in Sapotech UI for operators to check the condition of the tuyere area. Reports can be created in “Reports” section to evaluate the trends and to make conclusions about the remaining lifetime of refractories.
In simplest form, the system is plug and play. Power and compressed air is needed from the customer side. All the configuration work is done via Sapotech provided VPN device, no need for IT department to configure secure connections. If there is no level 2 integration, the operator needs to activate the imaging sequence from Sapotech UI. In the case of level 2 integration, imaging sequence can be automated.

Benefits

1. Immediate process evaluating

Changes in the tuyere area can be evaluated after every heat, allowing users to instantly see the impact of process changes.

2. Data collection and storage

Data from the tuyere area is easily and safely collected and stored for later analysis.

3. Consistent and objective decision making

Image data is always comparable; decisions can be made based on objective and consistent data.

4. Preventing critical refractory damage

Captured images can reveal sudden catastrophic wear of refractories or the loss of individual bricks, helping to prevent breakouts.

5. Trend indicators from algorithm detections

These include comparison of refractory wear and tuyere build-up to process practices, setting alarm limits, and even predicting converter tuyere area refractory life.

6. Plug-and-play solution

The system is fast and easy to implement, minimizing disturbances to daily operations.

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