

Customer Case:
To Secure Top Quality Slabs

Automated slab inspection line
ArcelorMittal
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Processes in steel industry are coming more accurate and automated, but there is still room for improvement for economical and environmental reasons. Sometimes these issues are contradictory, but talking about casting of slabs they have same interest.

Having a good control for casting process is helping to get down the cost of steel making process and ultimately the cost of produced slab. The environmental benefits are coming from letting out less CO2 and savings from energy consumption due less remelt.

So how can we improve the process to get these benefits? Lets take a look what we do now and what could be done to improve the process.

Today's situation

Controlling a caster is a very challenging task in majority of steel mills because there is no "instant" feedback for casts produced.

What most mills do is that they periodically take a small sample of the cast steel, etch it, and then try to detect what is the quality of the steel. The sampling is severely lagging behind the actual casting process. In case there are quality problems, such as corner cracking, porosity, black spots, or other defects, it is practically impossible to know, at point the defects starting appearing in the line. In the worst case this may cause millions of tons of scrap across in the process since there is no way of "repairing" what was cast - the only way to deal with it is to either sell it as lower grade or re-melt and try again.

One can imagine the magnitude of the problem by just thinking about the figures of a normal slab line producing 2 MT/a, or 5500 T/day. The costs are huge from wear on equipment, labour costs, internal and external transportation costs, energy consumption and lower yield in the process.

TABLE 1. SUMMARY OF MANUAL SAMPLING PROCESS

Manual slab inspection	
Sample processing time	Max 2 days
Number of concurrent samples	One
Relaying lead time to caster	Max 3 days
Worst case scrap production	16500T

What can be done to get a faster feedback from caster?

There are challenges like very hot and dangerous environment around the caster, and the time to get the samples cooled controlled and suitable for the steel grade in casting to be able to do the inspection possible. The answer is found from understanding the processing tasks and have under laying understanding of automated handling processes.

Pesmel Oy from Finland has developed a concept where a piece of steel can be analyzed practically on line and results can be used to control and track the performance of the caster.

Automated functions

A piece of cast metal (sample) is cut off from slab as soon as it exits the caster with torch cutter and lifted onto input conveyor of the inspection line. It is possible to transfer the heat number and at time all relevant data related to heat number from the mill computer system to the "brain" of the sample analyzer or simply key it into the terminal.

Automatically, based on the inserted information, the system knows if the sample has to be air cooled (to avoid cracking) first or if it can immediately be deposited to water quench tank.

After cooling, the system automatically moves the sample to a machining center, which removes the heat affected zone of the sample. The sample is ready to continue to the next step in the line.



After the sample's machined surface is automatically washed, etched and dried, a high resolution picture is taken from the sample. The picture is then saved under the heat number and sent directly to the caster pulpit to the caster operator. The operator analyzes the quality of the product and adjusts the casting process in case needed.

In the analyzing software, the operator can zoom in and has some standard rulers and triangles available in this PC based system. Each and every picture is automatically stored and, if needed, can be sent to the end customer as proof of the quality of the steel as it exited the caster. The sampling is - including the chemical handling - an unmanned process with zero operators required.

Benefits

Clear benefits of the automatic slab inspection line are:

- Reduces the output of scrap and increases yield up to 98%.
- Production of higher quality steel without adding any resources to the process.
- Reduction of the cost of quality sampling while significantly increasing the sampling as practically every heat can be etched - even multiple times.
- Provides steel producer a "Strategic Competitive Edge" by a possibility to send a picture of slab quality together with the slab.
- Provides outstanding tool to optimize the caster maintenance cycles as SPC can be fully implemented.

Summary

The old way involved a manual sampling process that had taken considerably longer and produced inferior results as can be seen in Table 1. In Table 2 here we can see the comparison with the new and old way.

TABLE 2	Automatic slab inspection	Manual slab inspection
Sample processing time	Max 90 minutes	Max 2 days
Number of concurrent samples	Multiple (design parameter)	One
Relaying lead time to caster	Max 1 hour	Max 3 days
Worst case scrap production	345T	16500T

Automatic inspection process has no limitations in the amount of stored data, like used to be the case earlier. The new way is unmanned and produces complete results that can be easily stored and utilized both in the quality management and customer service. It provides a significant reduction in downtime when changes are needed and reduces the amount of scrap.

References

Pesmel Automatic Slab Inspection line is successfully installed and in operation in ArcelorMittal, Canada.

