Implementation of a New Measuring Device for Cathode Current Distribution

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Abstract

The cathode current distribution (CCD) is giving essential information about the condition of a critical pot. In order to measure the cathode current distribution at the Hamburg smelter with a clamp tool, it is necessary for the operator to get underneath the pot. Risk of a tap-out during the measurement of iron pots is high. With the introduction of top down measurements, the operator safety was highly increased. Further improvement was made with the introduction of a measuring tool and a corresponding tablet device in 2012. The visualization of individual cathode current measurements of critical pots is used in day-to-day work of operators. The ease-of-use has increased the number of measurements per month, which is helping to gather more data preventing tap-outs. Due to faster identification of critical collector bars, less iron is dissolved and the overall metal quality increased.

Keywords: Electrolysis cells, operations, critical pots, cathode current distribution measurement.

1. Introduction

Using cathode current measurements for evaluation of critical cathode collector bar is a standard operation practice for pots with increasing age and iron levels at the Hamburg Smelter operated by TRIMET. By cutting a cathode collector bar of a faulty cathode, the life cycle can be extended [1]. Using a Halmar (now called Dynamp) Clamp-on Portable (COP) ammeter for collector bar currents measurements is a known practice [2].

The Hamburg smelter was restarted in 2007 after being shut down in 2005 by the former owner [3]. The smelter is equipped with 270 Reynolds P19 pots in two potlines with retrofitted siderisers. The pot has 18 anodes and 28 cathode collector bars. The nominal line current is 180 kA. During 2012, the Hamburg smelter had a crisis due to various factors. For the restart in 2007, 145 pots were reused; the others had to be relined with any material available on the market. During the economic crisis beginning with the end of 2008, 50 % of the pots were shut down again due to a reduced overall production. All of those were restarted in 2010. With some pots being restarted at least once, 102 pots were cut out of operation from 3 January 2012 to 28 December 2012 (see Figure 1).

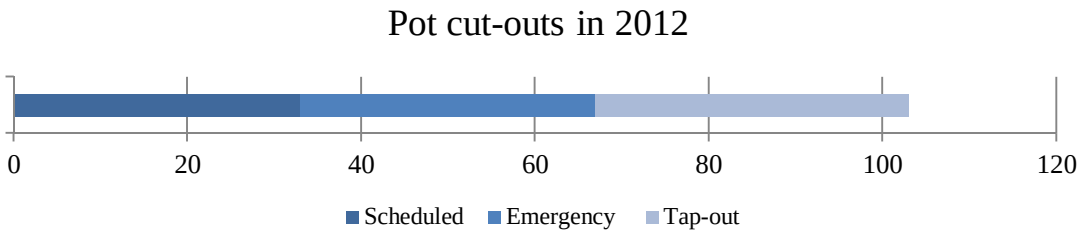

Figure 1. Pot cut-outs 2012, sorted by reason for cut-out.

A mere 33 were scheduled for a cut-out, the remaining either had to be shut down due to a tap-out or a emergency cut-out to prevent the tap-out. Pots were kept in operation as long as possible in order to supply metal to the cast house. One of the emergency cut-outs was pot 334 with a temperature of 1126 °C, 6.33 % Fe and with 12 of 28 collector bars disconnected.

2. Development of a New Tool

Until then, all measurements of cathode current distributions had to be done from underneath the pot with a Halmar COP portable ammeter. This is a major safety risk, especially with critical pots. As an additional risk, in Potline 2 the return busbar system is close to the other busbars. The complete basement of Potline 2 is therefore an electrical room, which may only be entered by electrically trained personnel. This led to the development of the top-down measurement with hall sensors. The schematic of the tool can be seen in Figure 2. The tool uses four Hall sensors, which are placed on both sides of the collector bar. The Hall sensors measure the magnetic field generated by the current in the collector bar. The current is calculated from the magnetic field. Measuring the magnetic field is more reliable than measuring voltage drop for a top-down measurement, as the collector bars can be covered in alumina or anode cover material. his would influence the measurement of the voltage drop drastically because a good contact with the electrical probes is difficult to make through the material.

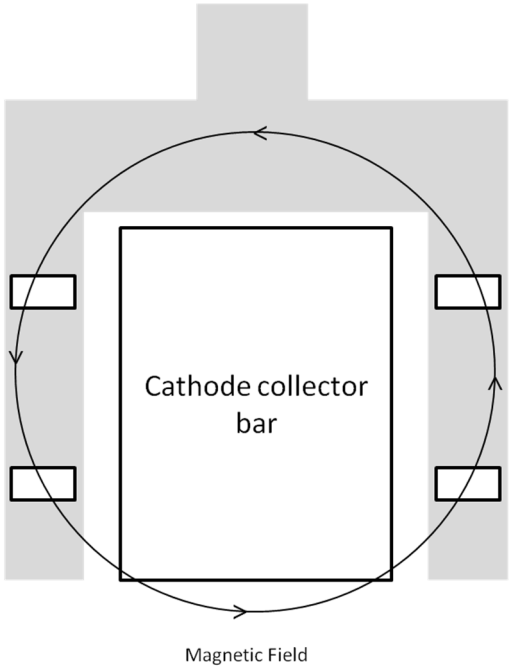

Figure 2. Schematic of measuring tool with 4 hall sensors. Rectangles on the side are Hall sensors.

With the first generation of this tool, the operators could measure the CCD from the top right next to the deckplate. One operator was holding the measurement fork, while a second operator was writing down the measured values. Afterwards the data was transferred to the level 2 database system.

The next generation measurement tool is using a tablet device and a Bluetooth connection to transfer the values via a database interface directly to the supervisory systems. The measuring schedule is generated from the database; the operator can select the individual pots and compare the measured values with the last measurement for an immediate overview and verification. If

5. References

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