Increased Reliability and Anode Quality by Using Statistical Process Control Tool at Paste Plant

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Abstract

Statistical Process Control is a well-known quality tool within the modern industry and commonly applied in the production processes of aluminum manufacturing plants. This paper presents the tool used for the maintenance strategy, in order to provide information to detect the main unplanned breakdown and bottlenecks of the green anode plant, aiming to guarantee reliable data for root cause analysis, aiding in the overcome of a very unstable condition. The methodology applied is very useful to identify nonstandard behavior and treat it by using root cause analysis as 5 why and Ishikawa diagram. Unplanned breakdowns at Paste Plant have a direct impact on the control of the process parameters and consequently on the paste and anode quality, the reduction of the interferent stops increase the number of preventive maintenance for the critical equipment to guarantee better results in the anodes properties, mainly green anode density. This paper aims to present the positive results that can be achieved using statistical process control tools as well as the good synergy between the operation, maintenance and process teams.

Keywords: Statistical process control, pareto, unplanned breakdown, anode quality, root cause analysis.

1. Introduction

Statistical Process Control (SPC) was a quantitative quality tool developed by Walter A. Shewart to improve the process of any plant. Today SPC is a tool which every company need to have and uses on its routines to have an advantage on today`s competitive market.

Statistical process control arises to aid in the engineering area to help make decisions under uncertainty. This happen because our world has so much variables, creating random variations in our engineering decisions. Furthermore, statistics helps us to make good decisions and avoid mistakes. Thus, when we talk about quality, to predict and remove failures, the use of statistical tools is very critical, because most deficiencies arise as the result of random variation [1].

According to the Handbook of Quality Engineer, a process is composed of a certain repetitive sequence of events that can lead to a tangible or intangible result. Due to its repetitive nature the process can be mapped and controlled through the SPC methodology, which uses statistical tools, to assist in the localization, resolution and prescription of problems [2].

Every process has variability and its sources can be classified in special and common events. The cause of common variability is inherent to the process by its characteristics, and that it is not controlled by the operators, for instance the variations of the environment, the plant and raw materials. Special causes of variations include unusual events, which when detected, are usually removed or adjusted.

A critical point of process management is the separation of common and special causes. Like when an operator has to do corrections in the process due to common causes, the result is much larger variations than if no action had been taken. This is called super-adjustment or super-control. However, when an operator does not treat a special cause, there is a large variation in the process. This is named as a sub adjustment or sub control. For these reasons, control worksheets are vitally important to help operators recognize the presence of special causes to take appropriate action.

Other critical point about SPC is that you can have all historic events about your process, and make critical analysis, measure performance, improvements, variations and correlate with the plant maintenance. It is the base in data collected by the operator or an automated system, to build control charts, which is easy to read and to interpret. By using the SPC, the engineer can start to see behaviors on the process, also take the necessary actions before the problem arises or start a critical failure analysis on the process. Data processing, root causes analysis, and all other activities supported by statistical process control can help to promote a synergy between areas (operation, maintenance, quality and process) with the focus on continuous process improvement. [2].

2. Methodology

As a maintenance strategy, the SPC was used to measure and analyze the behavior of the equipment in the Anode Plant. One of the main reason to use SPC is that it helps to identify nonstandard behavior of the equipment (trends, problems) and treat it. The SPC methodology is based on a control chart that allows the machine to talk to us as it is shown in the Figure 1.

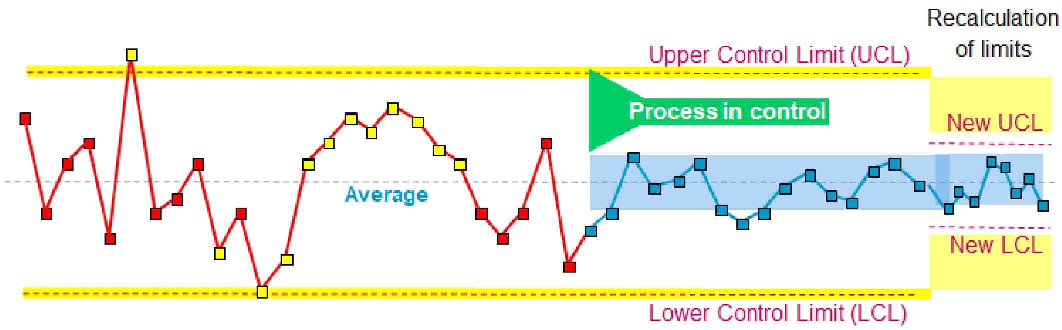

Figure 1. SPC control chart

As a control chart, the SPC has the Upper Control Limit (UCL) or under Lower Control Limit (LCL) that are the limit acceptable for the process [3]. Each point over the limit must have a Root Cause Analysis to figure out what happened. Three points closed to the limit or eight consecutive points over or below the average must have a root cause analyses as well.

When the process has eight consecutive points close to the average, it means that the process is getting stable and it is possible to observe a process change. Each process change must have a new UCL and LCL until the maintenance process achieve the target [4].

The SPC methodology is based on five steps: define the standard of the data base, measure the data, analyze it, improve process, check and control to keep it on control [5].

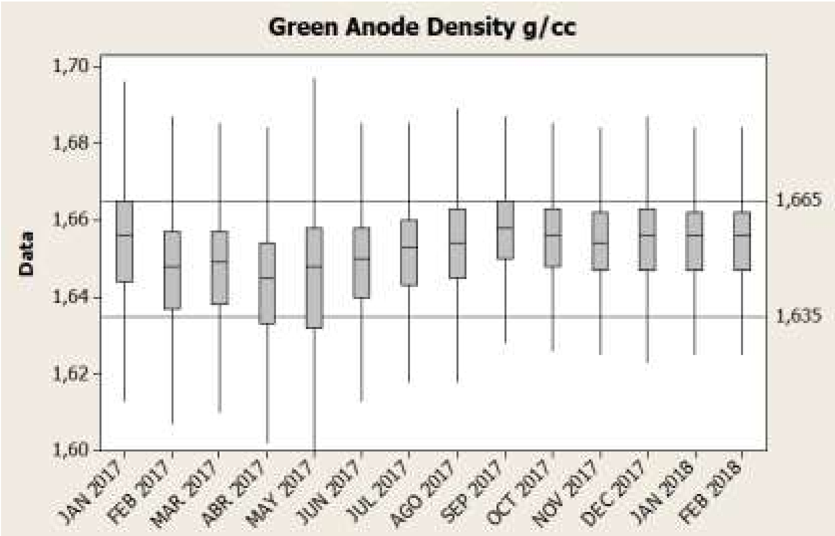

Figure 10. Graphic of Green Anode Density

The new situation made it possible, gradually, to carry out the planned activities needed to maintain the factory, once the number of green anode inventory sustain the overhaul and big maintenance stops as stablish in the plan of production. The firefighting cycle slowly became a progressive and productive cycle with positive feedbacks from the pot lines.

4. Conclusion

The systematic work had a positive impact in all disciplines involved in the anode manufacturing at Paste Plant. The application of this methodology allows us to identify the bottlenecks that most impact the process and lead our efforts to solve the problem, after all this work we could see the positive results begin to appear. It is important to emphasize that it is necessary that the entire plant is united to implement the SPC, gaining the control of the process after its phase of implantation and stabilization, resulting in a greater production, with products within the specification delimited by the control of the process.

5. References

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