Automatic Anode Effect Termination (AET) Strategies

Client: Asia Pacific Partnership, US EPA

Location: Henan Province, China

The Project

Anode effects (AE) are detrimental to aluminium smelting resulting in high voltage operation, increased energy consumption and generate CE_4 and C_2F_6 per-fluorocarbon-(PFC) greenhouse emissions. The aim of this project was to reduce the duration of AEs using an automatic AE termination (AET) strategy in place of manual termination by operators (more efficient and safer for operators). The emphasis was on faster termination of AEs, rather than prevention of AEs. This project was part of an Asia-Pacific Partnership for Clean Development & Climate (APP) effort, sponsored by the US EPA, IGSD and CNIA, to minimise PFC emissions in Chinese aluminium smelters.

Our Role

LMRC designed a strategy to quickly terminate AEs via alumina feeding and downwards anode beam movements, causing metal wave fluctuations which rapidly stop the AE. With the help of the control box manufacturers this logic was implemented into pot control boxes.

LMRC successfully tested the strategy on a single 400kA technology pot, which then led to a trial on a 36 pot section. Our engineers conducted both trials and data was gathered to measure the performance of the strategy.

The Results

The 36 pot trial demonstrated a 53% reduction in average AE duration from a baseline of 28s down to 13s. The proportion of pots with AE duration above 60s reduced from 7% to 1%, whereas AEs with duration 30-60s reduced from 26% to 7%. The automatic AET strategy was shown to be safe, without conflict to normal pot control or operations. Stabilising the pots allowed reduction in ACD which led to reduction in energy of 0.5kwh/ton Al.

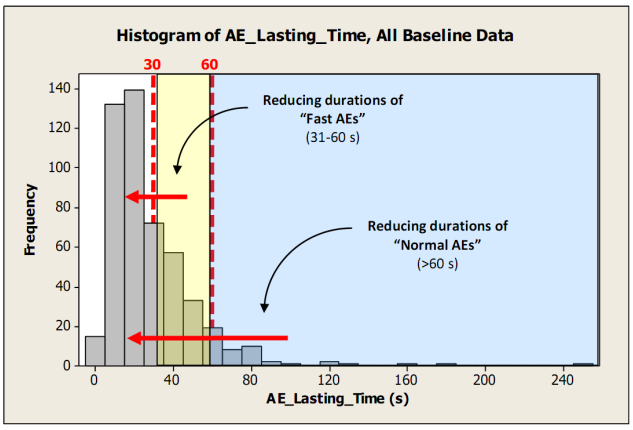

Figure 1: Histogram of AE durations (units in seconds) during the baseline period , showing the aim of the project.

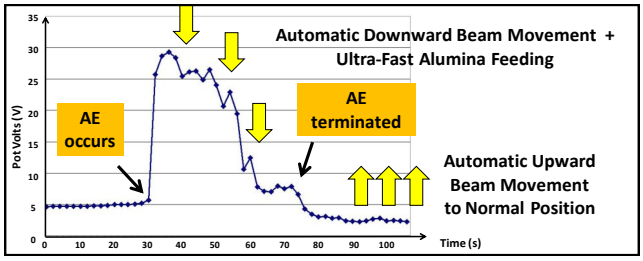

Figure 2: Diagram of cell voltage pattern on a single pot, during the automatic AE termination strategy.

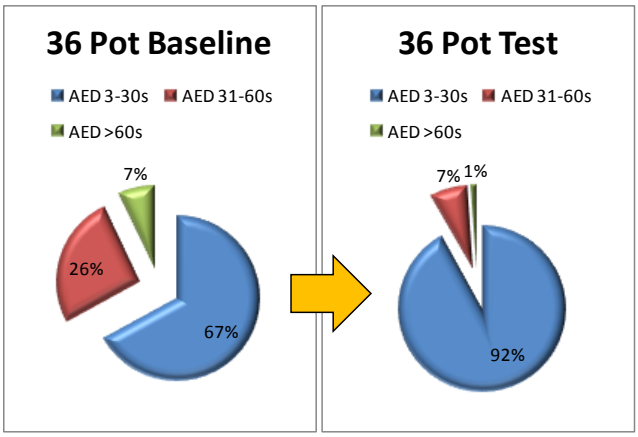

Figure 3: Distribution of AE durations (in seconds) for the 36 pot test section in the baseline period (left) vs. with the automatic AET strategy (right) .

LIGHT METALS RESEARCH CENTRE
THE UNIVERSITY OF AUCKLAND

uniservices