Managing Potlife through Statistical Analysis

Location: USA

The Project

A significant portion of ongoing costs in aluminium smelters comprises of electrolysis cell reconstruction. The cells undergo different wear mechanisms and failure modes determining their finite lifespan. Smelters have to carefully manage all aspects determining potlife to maximize it, while minimizing reconstruction costs. Pot design, materials and supplier selection, construction quality and electrolysis operations all affect potlife.

Although some cells will last over 3000 days, the average lifespan is between 1600 to 2500 days. With modern cells costing more than US$300,000, increasing pot life and controlling materials and reconstruction costs is a significant economic incentive.

Using statistical analysis tools, it is possible to get insights on all aspects affecting potlife and maximize capital return.

LMRC's Role

1. With the plant personnel, build a potlife database tracking cell designs, materials used operational history and failure mode of each cell
2. Use statistical analysis tools to understand the different failure modes and highlight materials weakness in the population
3. Recommend design changes or work with the plant on operational improvements to increase the cell life
4. Forecast and identify the cells to be rebuilt. This helps budgeting and planning for the plant, allowing cells to be taken out of service just before failure reducing cost and turn-around time.

The Results

This is an example where a particular sidewall material caused premature failures. Using statistical methods allows identification of problems only after a small portion of the cells have failed. This allows the smelter to take corrective actions to maintain the other weak cells in service.

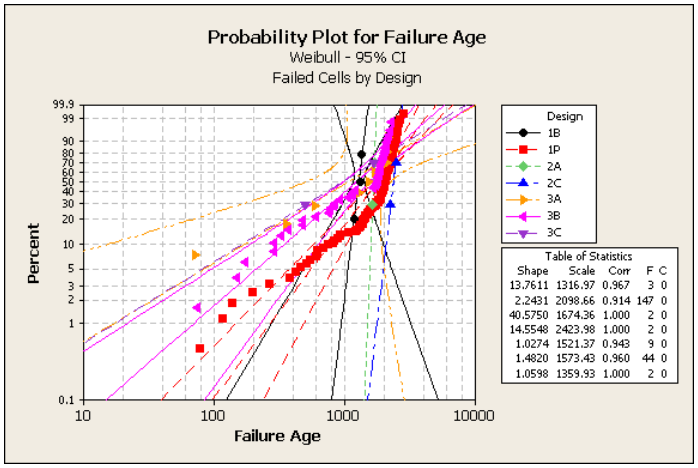

Figure 1: Failure age by sidewall type

Using individual age and probability of failure, forecasting and identifying cells to be rebuilt helps budgeting and planning

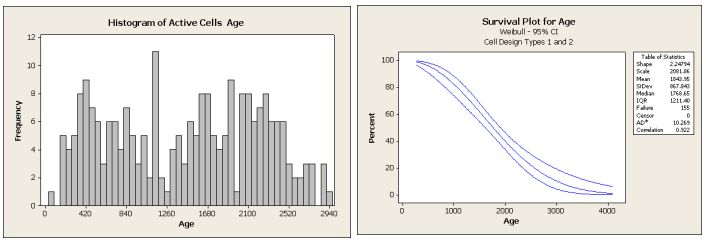

Figure 2: Age and Failure Probability

[Lavoie P. Advanced Materials Research Vol. 275 (2011)]

LIGHT METALS RESEARCH CENTRE
THE UNIVERSITY OF AUCKLAND

uniservices