Review of the SAMI Retrofit Project in QTX Smelter in China

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Abstract

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So far in the 21st century, the aluminium industry smelting capacity expanded rapidly in China through greenfield projects using recently developed Chinese high amperage cell technologies. The most recent being the 350-400 kA, 500 kA and 600 kA cells. In particular, the SAMI SY400 (400 kA), SY500 (500 kA), SY600 (600 kA) cell technologies, developed by Shenyang Aluminum & Magnesium Design and Research Institute (SAMI), have been widely used because of excellent MHD design. This period of rapid greenfield expansion has recently slowed down in China. Most realistically, in the near future, smelting capacity expansions will come mostly from brownfield retrofit projects, also named capacity creep projects. There is huge potential for such projects in China in particular, as most cells are designed to operate at relatively low anode current density in which it is easy to creep the capacity. This paper presents the SAMI retrofit project in the Quingtongxia Aluminium Smelter (QTX) in China, one of the few capacity-creep retrofit projects that has already been carried out in China and could be reproduced in other smelters both in China and abroad in similar low current density cell technologies.

Keywords: QTX aluminium smelter, SAMI cell technology retrofit, cell MHD models, cell thermo-electric models, cell key performance indicators.

1. SAMI Retrofit Project in QTX Smelter in China

Even if it is not very common and even less well known, some retrofit projects have been carried out in China recently. The SAMI retrofit project in Qing Tongxia (QTX) smelter is one of them.

In 2004, a GP350 potline containing 288 pots was started in QTX. Figure 1 presents the construction project schedule while Table 1 presents the obtained key performance indicators (KPIs) for that potline. This is a good example of non-optimal design suffering some important deficiencies like high instabilities up to 10 hours after an anode change, excessive ledge toe in the cell corners and reduced current in the corner anodes.

1.1 Magnetic Model

In 2008, SAMI was mandated for a retrofit project on that potline to improve the MHD and lining design. A magnetic model similar to the ones shown in Figure 2 was built to compute the magnetic field in the metal pad. As we can see, SAMI magnetic model is based on ANSYS. The vertical component of the magnetic field (B_z) of the GP350 model is presented in Figure 3. There is a non negligeable gradient of the B_z along the longitudinal direction of the cell. According to Urata [3] such B_z gradients are responsible for MHD bath/metal interface wave producing cell voltage instabilities.

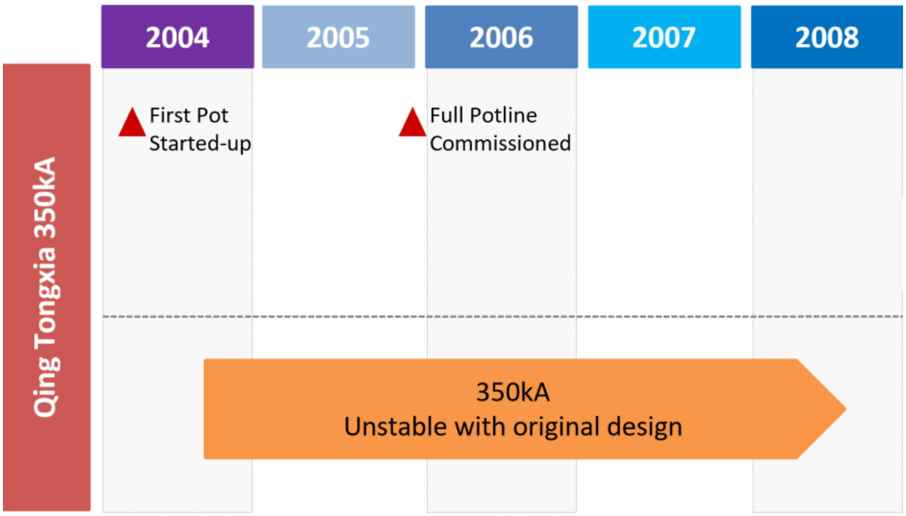

Figure 1. Commissioning schedule of the QTX GP350 potline.

Table 1. KPIs of the original QTX GP350 potline.

Parameter	Before Optimization
Potline amperage, kA	350
Current efficiency, %	90.5
Gross anode consumption, kg/t Al	557
Anode effect frequency / pot-day	0.085
Noise, mV	23
Excess AlF_3, %	5.5
Bath temperature, °C	964
Metal level, cm	27-30

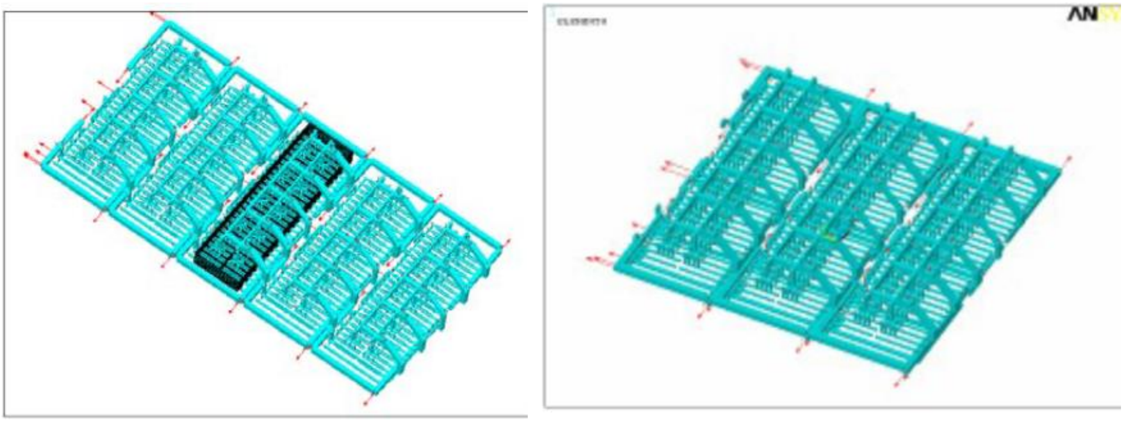

Figure 2. Left: SAMI's SY300 magnetic model, Figure 4 in [1], Right: SAMI's SY350 magnetic model, Figure 8 in [2].

4. Conclusions

The QTX smelter retrofit project illustrates SAMI's expertise to carry out successful retrofit projects. There are a great number of smelters inside and outside China that could benefit from this expertise.

5. References

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