# Retrofitting of Several Cell Technologies Using a Protruding Collector Bar Cathode Assembly

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**Abstract**

Since 2015, SAMI has been involved in several cell retrofits: SY200, SY235, SY300, SY400, SY500, GP500, NEUI500 and SY600. In all those retrofits, SAMI's cathode lining redeveloped with SAMI's New Conceptual Cathode Technology ("NCCT") has been used. For the first time the NCCT will be described here, it involves using a protruding collector bar cathode assembly, cast iron rodding and comes with a gas preheating procedure for the steel bar and carbon block. SAMI's NCCT was successfully adapted to different grades and sizes of cathode blocks over more than 2600 cells so far. Modeling results of the conception work will be presented but more importantly, KPI improvement of the retrofitted cells will also be presented.

**Keywords:** Aluminium, Modeling and simulation, Cell retrofit, KPI, Cast iron rodding, Gas preheat

## 1. Introduction

Reference [1] is presenting SAMI's retrofit of the GAMI's GP350 into the SY370 at QTX smelter in China. That retrofit involved the addition of two compensation loops to reduce the Bz intensity and the introduction of SAMI's proprietary Horizontal Current Reduction Technology ("HCRT") cathode technology to reduce the horizontal current in the metal pad.

References [2] and [3] are presenting SAMI's retrofit of the SM-17SE into the SY240 at Inalum smelter in Indonesia. That retrofit involved the introduction of SAMI's proprietary NCCT cathode technology to reduce the horizontal current in the metal pad. The NCCT cathode technology is not described in [2] and [3] but it will be fully described in here.

SAMI started to work on the NCCT cathode technology in 2010 so just after the development of the HCRT cathode technology. HCRT is based on split bar technology [4] and [5] while NCCT is based on the usage of protruding collector bar cathode assembly, the design concept will be presented below. What also differentiate NCCT from HCRT is the introduction of cast iron rodding in NCCT. As presented in [1], HCRT cathode technology reduces the horizontal current by about 30 % while NCCT cathode technology reduces the horizontal current by about 40 % as presented in [2] and [3].

SAMI used NCCT cathode technology to retrofit several smelters in China using a wide variety of cell technologies. The resulting gains will be presented here altogether with the new resulting KPI. But before, that the modeling work and the design concept will be presented.

## 2. Thermo-Electric Modeling Work to Reduce Horizontal Current

The aim or the NCCT development work was to reduce the metal pad horizontal current by more than the 30 % already achieve by HCRT. To achieve that goal, it was decided to try to replace the traditional mix rodding by cast iron rodding. This change was first investigated in the 3D thermo-electric full cell slice model. Figure 1 is presenting the model mesh. Figure 2 is presenting the resulting temperature and converged ledge profile, while Figure 3 is presenting the resulting metal pad current density for the case of the SY240 as already presented in [2].

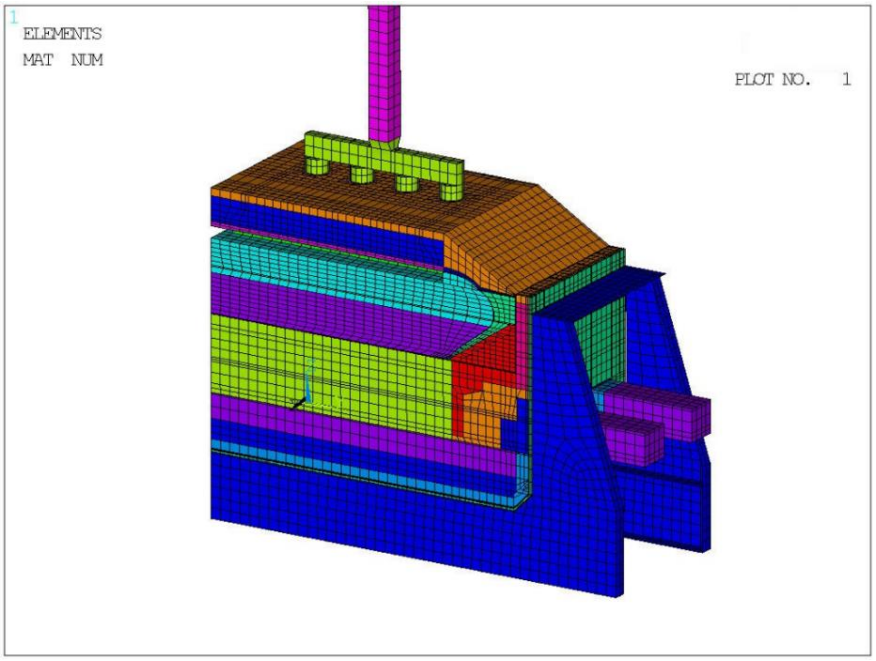


**Figure 1. Thermo-electric 3D full cell slice model mesh.**

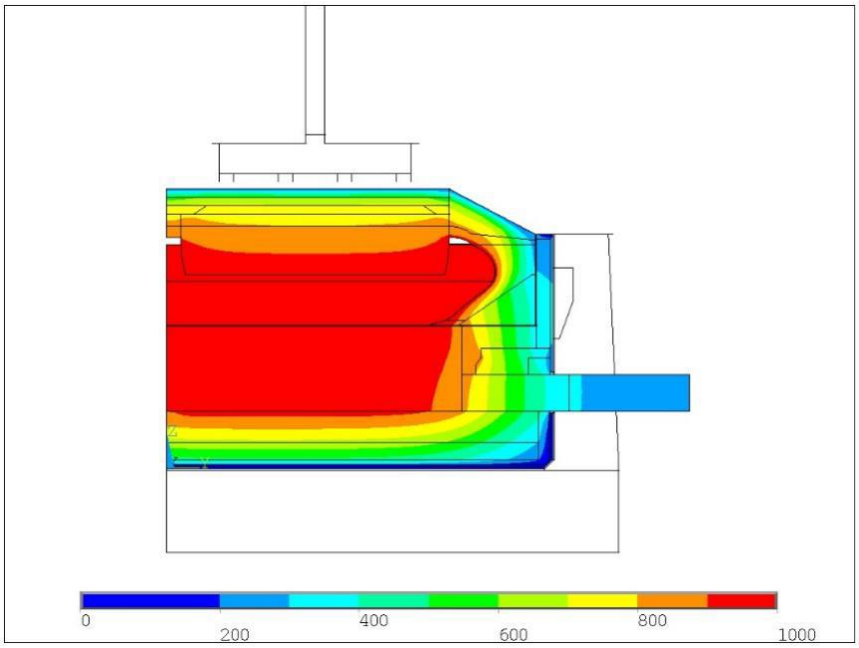


**Figure 2. Thermo-electric 3D full cell slice model isotherms (°C).**

**Table 2. New KPI after adoption of NCCT.**

| Cell kA | Smelter name | Technology | Production t Al/cell-day | Current Efficiency % | Cell Voltage V | DC Energy Consumption kWh/t Al |
|---|---|---|---|---|---|---|
| **500** | Xinjiang Agricultural Sixth Division | SY500 | 3.756 | 93.3 | 3.860 | 12332 |
| **200** | Chalco Qinghai Branch | SY200 | 1.567 | 90.54 | 3.769 | 12408 |
| **235** | Inalum | SY240 | 1.819 | 96.11 | 4.094 | 12697 |
| **300** | Turkey ETI Aluminium | SY300 | 2.328 | 95.12 | 4.071 | 12757 |
| **400** | Xinjiang Tianlong | SY400 | 3.016 | 91.6 | 3.952 | 12862 |
| **500** | Inner Mongolia Huayun Phase I | SY500 | 3.792 | 94.18 | 3.92 | 12406 |
| **500** | Yingkou Zhongwang | SY500 | 3.801 | 94.4 | 4.006 | 12650 |
| **500** | Guangxi Hualei | GP500 | 3.794 | 94.23 | 3.945 | 12480 |

## 8. Conclusions

The NCCT involves using a protruding collector bar cathode assembly, cast iron rodding and comes with a gas preheating of the steel bar and carbon block technology. It can reduce the CVD and horizontal current of cells at the same time.

Now, SAMI's NCCT has been successfully adapted to different grade and size of cathode blocks in over more than 2 600 cells, including new construction and technical upgrading of 200–660 kA electrolytic cells with good performances as demonstrated by the KPI improvements.

## 9. References


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