

Successful Implementation of INALUM Pilot Cells Using EGA Cell-Upgrade Technological Know-How

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Abstract

EGA and INALUM signed a Technology License Agreement on 21 December 2020 to upgrade INALUM Potline 1 reduction cells consisting of S170 Sumitomo technology at Kuala Tanjung smelter. The purpose of the agreement is to use EGA technological know-how to increase the smelter's hot metal production. In the first stage of the project, five pilot cells were upgraded in Potline 1 and are now operating at 215 kA, which is 20 kA higher than the nominal Potline 1 amperage of 195 kA. The key technological upgrade of the pilot cells included improvement of potlining design, superstructure with point feeders, busbar network, and replacement of existing cell control system with EGA's PLC-based cell control system. Process improvements based on EGA know-how and experience included preheat, start-up, early operation, and normal operation.

INALUM's project team faced various challenges during the project execution to implement the upgraded design. The challenges were caused by limited resources and facilities, regulations, the COVID-19 pandemic, raw materials supply, and modification of cathode ring busbar without disturbing the operation of Potline 1. Despite all these challenges, with good project management and collaboration between EGA and INALUM, the start-up of the five pilot cells was completed safely from 25 May 2023 to 9 June 2023.

The Technology License Agreement included a contractual obligation to carry out a performance test on the five pilot cells for a period of 4 weeks with metal production of 1 619 kg/cell-day at 215 kA. The performance test took place from 27 August to 24 September 2023.

EGA's operation and process technology advisors were on-site to lead, supervise and provide necessary support during the cell start-up and performance test. The pilot cells successfully achieved a performance of 1 641 kg/cell-day at 215.4 kA during the performance test. The successful completion of the performance test is a landmark achievement reflecting efficient collaboration and teamwork between EGA and INALUM. The success of the pilot cells is the

starting point for EGA and INALUM to upgrade all 298 cells in Potline 1 (128 cells) and Potline 3 (170 cells) in Kuala Tanjung smelter.

Keywords: INALUM upgrade pilot cells, EGA cell upgrade technological know-how, Cell performance test.

1. Introduction

Emirates Global Aluminium is the world's leading 'premium aluminium' producer with operations from mining and refinery to smelting and casting. EGA is also a smelting technology provider for greenfield and brownfield projects. PT Indonesia Asahan Aluminium (Persero), INALUM, is a 100 % state-owned enterprise since 2013 whereas before, since its establishment in 1976 it was a Joint Venture Company between the Government of Republic of Indonesia (GOI) and 12 Japanese investment companies.

EGA and INALUM signed a Technology License Agreement on 21 December 2020 to upgrade INALUM reduction cells operating with S170 Sumitomo technology at Kuala Tanjung smelter. The pilot section consists of five test cells installed in the existing Potline 1 (Cells R117 to R121), connected to an existing booster rectifier intended to operate cells at 215 kA. Potline 1 was operating at 195 kA at the start of the project.

The INALUM upgrade project went through various phases described in this paper.

The start-up of the pilot cells began on 25 May 2023 at 195 kA, and was completed on 9 June 2023 at 196 kA. The amperage was increased to 215 kA from 21 June to 10 July 2023.

2. EGA Feasibility Study of INALUM's Existing Cells

EGA has great experience in upgrading existing potlines with continuous development of its own technologies in EGA for production increase and environmental protection, as well as in the design and operation of advanced high amperage technologies [1]. Of particular relevance for the INALUM project is EGA's upgrading of Kaiser P68 to D18, and to D18+ technology, since P69 was similar to S170 Sumitomo technology with end anode risers and similar amperage [2-4]. EGA also has full mathematical modelling capability for cell design and amperage increase strategies [5-6]. EGA has an advanced PLC-based cell control system [7].

The feasibility study consisted of modelling, measurements and design validation of INALUM's existing cells and the evaluation of the existing potline operation and control practices as well as the selection of the pilot section for five test cells in Potline 1 (Cell R117 to R121) for convenient connection to an existing booster rectifier.

The feasibility study was based on the requirement to increase INALUM production capacity from 250 000 to 300 000 t/a through the upgrade of the existing Potlines 1 and 3, which would require an amperage increase to 215 kA.

The pilot project plan envisaged EGA modelling and cell design, engineering of the proposed upgrade, and onsite support by EGA engineers for construction, start-up and early operation of the five pilot cells. The new cell technology was named S170+. The scope of the upgrade project is shown in Figure 1

- Net specific energy of 13.58 kWh/kg Al based on adjusted current efficiency as compared to 14.05 kWh/kg Al for Potline 1,
- Gross carbon consumption of 620 kg/t Al (55 kg less than Potline 1),
- Net carbon consumption of 421 kg/t Al (51 kg less than Potline 1),
- PFC Emissions (CO₂-eq.), as per calculation in [10], of 48 kg/t Al as compared to 531 kg/t Al of Potline 1.

9. Conclusions and Way Forward

The INALUM pilot cells upgrade project achieved performance above the contractual obligations. Five pilot cells were retrofitted with minimum disturbance to the existing potline infrastructure, such as building, crane, feeding system, etc. The upgrade of superstructure, busbar network, potlining, potshell was managed onsite with local contractors. The cell control system was supplied and commissioned by an external EGA approved contractor. The great collaboration and teamwork between EGA and INALUM project and operation teams contributed greatly to the success of the project.

The successful upgrade of five pilot cells using EGA upgrade technological know-how will pave the way for the upgrade of INALUM's existing 298 cells in Potline 1 and Potline 3. EGA is continuously monitoring the five pilot cells remotely from Jebel Ali office and is providing technical support to INALUM operation for stable operation of the pilot cells.

10. References

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