

# Production of Al-Sc alloy by electrolysis in cryolite melt using $\text{Sc}_2\text{O}_3$ feed. Results obtained in a large-scale laboratory cell

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In the frame of the SCALE project, SINTEF is investigating the possibility of modifying the industrially established process for reduction of alumina to aluminium, the so-called Hall-Heroult process, and then apply it for the direct production of Sc-Al alloys.

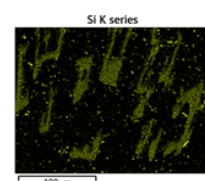
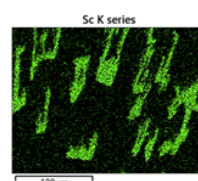
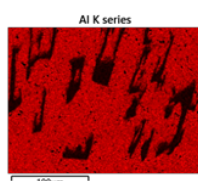
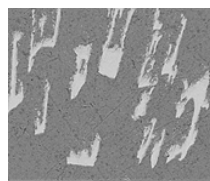
In order to examine the evolution of the electrolyte composition over time, a long-term trial was carried out using a large-scale laboratory electrolysis cell. Electrolysis was carried out at galvanostatic mode for 26 h in a continuous operation, from a cryolite melt at 980 °C while feeding  $\text{Al}_2\text{O}_3$  and  $\text{Sc}_2\text{O}_3$  using an automatic screw feeder.

Approximately 750 g metal was harvested from the bottom of the reactor after it had been cooled down to room temperature. ICP-MS analysis of the metal showed a content of ca. 0.6 wt% Sc. However, high Si contents were also discovered, this due to the cell materials used (linings, insulation material, etc). The current efficiency calculated after the metal harvested was ca. 63%.

Moreover, the electrolysis off-gas was monitored on-line by using an FTIR ( $\text{CO}$ ,  $\text{CO}_2$ ,  $\text{CF}_4$  and  $\text{C}_2\text{F}_6$ ) and a tunable diode laser ( $\text{HF}$ ,  $\text{H}_2\text{O}$ ) equipment. This would allow monitoring anode effects, as well as the environmental performance of the semi-open reactor.



*Metal recovered*



*SEM-EDS analysis of the metal product.*

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