Influence of Hooding Conditions on Gas Composition at the Duct End of an Electrolysis Cell

Lukas Dion[1], László I. Kiss[2], Sándor Poncsák[3] and Charles-Luc Lagacé[4]
1. PhD Candidate in Engineering,
Aluminum Research Centre-REGAL, UQAC, Chicoutimi, Québec, Canada
2. Professor in Applied Sciences and Director of the GRIPS (Groupe de recherche en ingénierie des procédés et système),
3. Research Professor,
GRIPS, Université du Québec à Chicoutimi, Chicoutimi, Québec, Canada
4. Advisor in continuous improvements
Aluminerie Alouette Inc., Sept-Îles, Québec, Canada
Corresponding author: lukas.dion@uqac.ca

Abstract

Aluminum smelters are known to be important producers of perfluorocarbons (PFC). These gases are generated when the localized overvoltage in the cell exceeds the threshold necessary to electrolyze the cryolite, hence generating an anode effect. When it remains localized, this event is difficult to identify and it can generate only a small amount of PFC for several hours. Under these conditions, the cell behavior is almost undisturbed and no action is initiated from the cell control system to correct the situation. To understand this phenomenon, it is common to extract the gas from the duct end of specific cells - where dilution is minimal - and measure the gas composition continuously using a Fourier-transformed infrared spectrometer (FTIR). However, air infiltration can affect the measured PFC concentration, and the gas flow rate in the duct of the cell. In this study, a tracer gas was injected into the cell under multiple scenarios to assess the impact of the hooding conditions on the flow rate and concentration of the measured gases. This investigation quantified the uncertainty associated with the measurements of the gas composition for six specific scenarios compared to optimal hooding conditions.

Keywords: Aluminum electrolysis; perfluorocarbon emissions; low voltage anode effect; hooding condition; FTIR measurements.