Modelling and Design of a Forced Convection Network for Hall-Héroult Cells

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Abstract

Forced convection networks (FCN) are now commonly used in the aluminum reduction technology to increase the heat transfer from the sidewalls of the cells. This both cools down the potshell and increases the ledge thickness, potentially leading to additional amperage creep in the smelter. Proper design of a FCN requires a combination of modelling tools: a computational fluid dynamics (CFD) model to predict the air flow pattern and heat transfer coefficients on the shell, a thermal model to evaluate the ledge response inside the cell, and pressure loss calculations to design the pipe network. In this work, we present the approach that has been developed at Rio Tinto Aluminum to design and optimize the FCN configuration. The models are validated based on measurements taken in the potroom. Finally, a case study illustrates how the approach can be applied.

Keywords: Forced convection network; computational fluid dynamics; cell modelling.