The Effect of Varying Mixing and Baking Temperatures on the Quality of Pilot Scale Anodes – A Factorial Design Analysis

Camilla Sommerseth[1], Rebecca Jayne Thorne[2], Arne Petter Ratvik[3], Espen Sandnes[4], Hogne Linga[5], Lorentz Petter Lossius[6] and Ann Mari Svensson[7]

1. Research scientist
Norwegian University of Science and Technology, Materials Science and Engineering, Trondheim, Norway
SINTEF Materials and Chemistry, Trondheim, Norway
2. Scientist
Norwegian University of Science and Technology, Materials Science and Engineering, Trondheim, Norway
Norwegian Institute for Air Research, Kjeller, Norway
3. Senior research scientist
SINTEF Materials and Chemistry, Trondheim, Norway
4. Associate professor
7. Professor
Norwegian University of Science and Technology, Materials Science and Engineering, Trondheim, Norway
5. Program manager
6. Principal engineer
Hydro Aluminium AS, Årdal, Norway
Corresponding author: camilla.sommerseth@sintef.no

Abstract

Identifying optimum anode baking and mixing temperatures are important when producing high quality anodes. The effect of varying mixing and baking temperatures were investigated in terms of the resulting anode density, specific electrical resistivity (SER), air permeability, coefficient of thermal expansion (CTE) and air and CO_2 reactivity. Six pilot scale anodes were prepared at Hydro Aluminium AS using a single source petroleum coke and < 2 mm coke fractions. A coal tar pitch was used with a Mettler softening point of 119.1 °C. The aggregate was mixed at 150 °C or 210 °C, and baked at 1150 °E, 1260 °E or 1350 °E. A 2^2 full-factorial design analysis was performed in order to determine the response of the analyzed properties to the applied mixing and baking temperature. Density, SER and air permeability were found to be highly dependent on the mixing temperature. Density and SER was also slightly affected by the baking temperatures. CTE was found independent of both the baking and mixing temperature. Air reactivity was found to be mainly dependent on the baking temperature, while CO_2 reactivity was dependent on both mixing and baking temperature. The use of the factorial design as a statistics tool is strong when investigating the effects and covariance of various production parameters.

Keywords: Carbon anodes; effect of mixing temperature; effect of baking temperature; anode performance; factorial design.