ALUMINUM

Project Fact Sheet

Wettable Ceramic-Based Drained Cathode Technology for Aluminum Electrolysis Cells

Benefits

- Potential total energy savings of 1,500 megawatts (MWe) per year (when applied to the current U.S. annual production of aluminum)
- Potential to increase cell efficiency by 13 to 20 percent

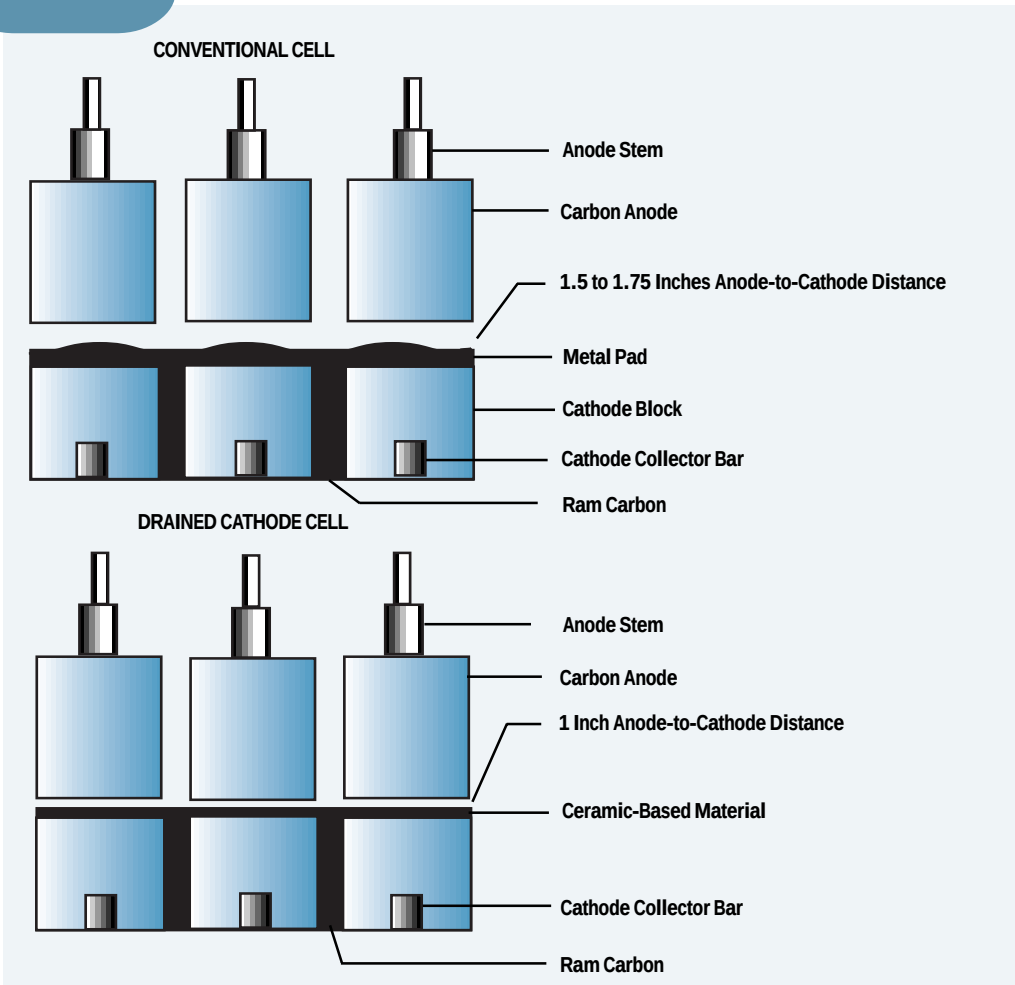
Application

Through successful development, the *Wettable Ceramic-Based Drained Cathode Technology for Aluminum Electrolysis Cells* project promises to provide stable ceramic cathode lining materials for reduced energy consumption during aluminum production.

New technology will reduce energy during aluminum production

Reynolds Metals Company, Kaiser Aluminum & Chemical Corporation, and Advanced Refractory Technologies (ART) will collaborate to develop and evaluate ceramic-based materials and the necessary engineering packages to retrofit existing reduction cells as a means to improve the performance of the Hall-Héroult cell. ART will produce ceramic-based tiles or coatings that will be used as the "drained" lining in two 70 kiloampere (kA) prebake cells. The durability of the candidate materials and the performance of the drained cathode design will be evaluated during a one-month test using 12 kA pilot reduction cells.

Cathode Cells



Conceptual schematic drawing of a conventional cathode cell versus a drained cathode cell.

Project Description

Goal: Develop ceramic-based materials and necessary engineering packages to retrofit existing reduction cells in order to reduce the energy consumption required for making primary aluminum.

The ceramic materials will be used in a drained cathode configuration which will provide a stable, molten aluminum wetted cathode surface. By eliminating the wavy, irregular molten aluminum pool as the cathode and replacing it with a stable ceramic surface, the anode-to-cathode distance can be reduced, thereby reducing the electrical resistance. Stable operation of the new cathode technology will require the development of new process control algorithms for the management of alumina feeding, anode bridge movements, and increased sensitivity to cell instability.

This project includes the following activities:

1. Development and evaluation of candidate ceramic-based materials (tiles or coatings);
2. Development of the drained cathode cell design;
3. Evaluation of candidate materials and drained cathode cell design in 12 kA pilot cell tests; and,
4. Evaluation of candidate materials and drained cathode design in retrofitted 70 kA prebake cell tests.

Progress and Milestones

- Develop Cathode Materials and Manufacturing Techniques (Spring 1999)
- Design, Operate and Evaluate Two Pilot Cell Tests (Spring 2000)
- Design, Operate and Evaluate Two Industrial Cell Tests (Summer 2002)

Commercialization Plan

Long-term (three-to-four years) confirmation of the durability of the ceramic-based materials and cell operational practices at the Kaiser Aluminum Mead Works Plant with eventual expanded use of the wettable ceramic-based cathode technology throughout the entire aluminum reduction plant.

Project Partners

Advanced Refractory Technologies
Buffalo, NY

Kaiser Aluminum & Chemical Corporation
Kaiser Aluminum Mead Works Plant
Mead, WA

Reynolds Metals Company
Muscle Shoals, AL

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