ALUMINUM

Project Fact Sheet

In-Line Annealing of Continuous Cast Sheet

Benefits

This project will allow continuously cast sheet to be used in a wider array of forming applications. The benefits of continuous casting include:

- 25 percent energy reduction relative to conventional casting
- 14 percent cost reduction relative to conventional casting
- Consistently high quality product
- Reductions in CO_2 and NO_x concomitant with reduced energy consumption

Applications

This project will enable further applications of continuous casting technology by making the process more cost effective and more energy efficient. In particular, in-line annealing is needed for the cost effective production of sheet products for meeting the formability requirements of large-scale industrial applications.

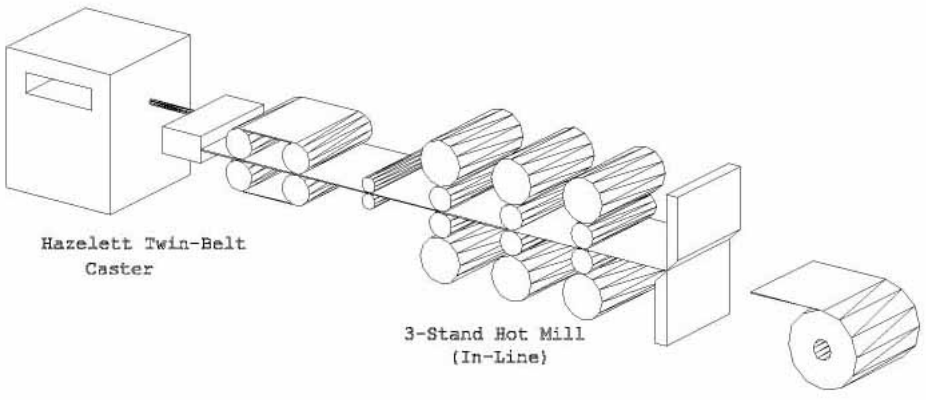
Evaluation and Characterization of In-Line Annealed Continuous Cast Aluminum Sheet

For more than fifty years, the majority of aluminum strip, sheet and plate products have been produced by combinations of hot and cold rolling and annealing of large ingots. In contrast, aluminum sheet made by continuous casting provides an energy savings of at least 25 percent and an economic savings of more than 14 percent over sheet products made from an ingot. Formability is among the most important characteristics of aluminum sheet. Tensile and yield strength, ductility, and rates of work hardening control the complexity of the shapes that can be formed out of a sheet. Careful control of the final microstructure, texture, and strength throughout the sheet is required to give it good forming properties.

Continuous cast aluminum sheet is directly cast, hot rolled and coiled. The sheet is not homogenized or held at a high temperature. This eliminates or decreases chemical segregation within the sheet before or during hot rolling. This structure characteristic is very important for aluminum alloys in subsequent processing. These alloys must have a uniform microstructure throughout the sheet in order to achieve the desired formability properties. The introduction of in-line heating/annealing prior to coiling could ensure optimum sheet formability.

This project will develop in-line heating/annealing protocols for continuously cast aluminum sheet prior to coiling. The focus is on utilizing a process optimization model and increasing the understanding of the evolution of microstructure and microtexture in continuously cast sheet during in-line anneal. The implementation of this work will result in the production of continuous cast alloy sheet with improved formability at high levels of productivity, consistency and quality.

Continuous Casting



In-Line annealed continuous cast aluminum sheet.

Project Description

Goal: The goal of this project is to develop optimized, energy and cost efficient thermo-mechanical processing procedures for in-line annealing of continuously cast aluminum alloy sheet with an improved formability. The goal will be achieved through a collaborative research program involving the aluminum industry, the Department of Energy, a National Laboratory and academia.

Progress and Milestones

- **In-Line Annealing** - Design, build, install and evaluate pilot-scale in-line annealing equipment using induction heating technology.
- **In-Plant Trials** - Conduct parametric studies of the influence of in-line annealing and mill parameters on the properties of aluminum sheet. The process parameters include line speed, sheet thickness and in-line annealing power.
- **Optimization Modeling** - Employ the use of a metallurgical model for optimizing process variables to develop a fundamental understanding of the influence of materials and thermo-mechanical processing variables on the evolution of microstructure and texture in aluminum sheet.
- **Material Characterization** - Analyze microstructural texture, strength and formability of material sheet processed using in-line annealing technology. This will provide data that can be used for the design, development and optimization of alloy processing parameters and for validating process optimization models.
- **Cost Evaluation** - Evaluate the cost benefits of commercial scale in-line annealing systems.

Commercialization Plan

The project partners have a clear and direct interest in implementing the technologies developed in the project. Commercial adoption of the technologies developed in this project will take place through the active participation of the project partners. The technologies developed during the project will be transferred to the participating companies continually throughout the life of the project.

Project Partners

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Ajax Magnethermic Corporation
Warren, OH

Charles River Associates
Boston, MA

Commonwealth Aluminum
Louisville, KY

Oak Ridge National Laboratory
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