ALUMINUM

Project Fact Sheet

DEGASSING OF ALUMINUM ALLOYS

BENEFITS

- Potential cost savings of $20 million per year by 2015
- Estimated cost benefit from the lower dross formation is estimated to be an additional $16 million per year
- Energy savings of 2.4 trillion Btu are expected from full implementation of this technology by 2015
- Potential emissions reduction include .046 kTCE of carbon dioxide and .6 k tons of NOx displaced by 2015

APPLICATIONS

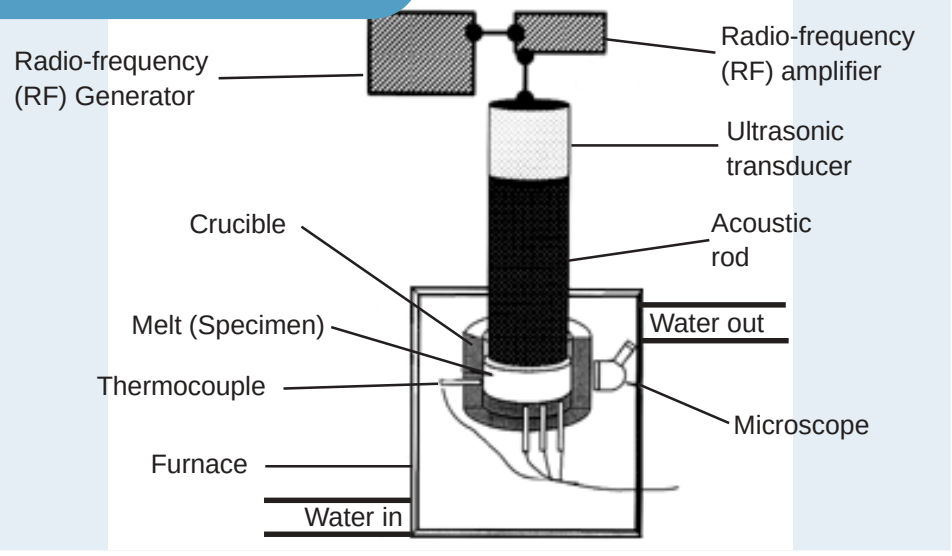
The energy benefits and cost savings from the introduction of this technology would occur through the reduced dross formation during the degassing process and from the reduced argon usage for degassing of aluminum alloys.

DEGASSING OF ALUMINUM ALLOYS USING ULTRASONIC VIBRATIONS

Dissolved hydrogen evolves as porosity during the solidification of aluminum alloys and is detrimental to the mechanical properties of castings, heavy section plates, and forgings. Reducing porosity during casting is a challenging problem in the aluminum industry. Degassing is the most effective way of reducing porosity. Degassing involves bubbling argon and/or other gases through the melt to absorb hydrogen and other impurities. As these bubbles break the surface, aluminum is lost to oxidation by the furnace gases and entrapment in dross. Ultrasonic degassing uses high intensity ultrasonic vibrations to generate oscillating pressures in molten aluminum. Oscillating pressure will produce cavitation and break gas bubbles into smaller, more dispersed and effective absorbers of hydrogen. The result will be lower gas use and less surface bubbling that results in lost aluminum.

This research will evaluate core principles and establish quantitative bases for the ultrasonic degassing of aluminum alloy melts, and demonstrate the application of ultrasonic processing during ingot casting and foundry shape casting. Important issues to be studied and solved include the coupling of the ultrasonic transducer to the melt, the effective transmission and distribution of ultrasonic vibrations in the melt, ultrasonic vibration intensity and frequency, and protection of the melt surface. The research will develop laboratory scale equipment for ultrasonic degassing, study the effect of process parameters, and identify the range of applicable process parameters for commercial implementation of the technology.

EXPERIMENTAL APPARATUS



Experimental apparatus for studying the degassing of aluminum alloy melts.

Project Description

Goal: The goal of this research is to understand fundamentally the effect of ultrasonic energy on the degassing of liquid metals and the development of practical approaches for the ultrasonic degassing of alloys.

The result of ultrasonic use will be a degassing process in which less argon is needed and less aluminum is exposed to the furnace gases. This saves energy by reducing aluminum oxidation and the energy needed for argon production.

Progress and Milestones

- Assemble apparatus for the investigation of the effect of ultrasonic energy on the degassing of aluminum alloys.
- Study the degassing of aluminum alloy melts using the experimental apparatus.
- Determine the fundamental mechanisms of ultrasonic degassing of alloy melts.
- Develop models for the application of ultrasonic degassing to large melts possibly conducting industrial trials.

Commercialization Plan

Industry participants will have a significant opportunity in the evaluation of the technologies and results of the information generated from this research. This research will include several mechanisms for the commercialization of the information, including project review meetings, the organization of task groups to review the results, and the presentation of the information at national meetings. These activities will insure a broad based economic impact that goes beyond the project team participants, identify and implement commercialization opportunities in a wide array of markets and applications, and promote and accelerate technology transfer and commercialization of ultrasonic degassing.

Project Partners

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Oak Ridge National Laboratory
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Ohio Valley Aluminum Co., LLC
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