METAL CASTING

Project Fact Sheet

NON-INCINERATION TREATMENT TO REDUCE BENZENE AND VOC EMISSIONS

SIMPLE TREATMENT SYSTEMS CAN BE A COST EFFECTIVE TECHNIQUE TO REDUCE EMISSIONS IN GREEN SAND FOUNDRIES

BENEFITS

- Estimated energy savings of 0.85 trillion Btu in 2010.
- AO/AO-UWAP processing, a low energy alternative, compared to conventional incineration techniques currently employed.
- Have the potential to reduce one-third of casting industry VOC emissions.
- Improves molding system performance.

APPLICATIONS

The results of this project could be applied in green sand foundries throughout the casting industry and could replace current incineration techniques for emission control. Sand casting remains the dominant casting method used in the U.S. today. Therefore the potential application is widespread.

Cost-effective non-incineration techniques will significantly reduce volatile organic carbon (VOC) and benzene emissions from green sand foundries. Increasingly, green sand foundries must reduce benzene and VOC emissions during pouring, cooling, and shakeout. Conventional incineration systems to treat stack gases are costly to operate and difficult to maintain. Alternative pollution treatment methods are needed to comply with air quality requirements. Full-scale plant trials at green sand foundries have shown that simple, non-incineration advanced oxidation (AO) treatment systems or a combination of AO with underwater plasma (AO-UWAP) treatment can greatly reduce emissions. In AO and AO-UWAP treatment systems, wet collector sludge, or sand system baghouse dust is passed through a water slurry that has been preconditioned with ozone, hydrogen peroxide, and sonification/plasma treatment.

Pennsylvania State University and industry partners are evaluating the use of AO, and AO with an underwater plasma, as a green sand "additive". AO can be added to a foundry's green sand system wherever water is. In production, before water or black water slurries are added to the sand, they are treated with small amounts of AO combined with an ultrasonic treatment. It is believed that AO treatment cleans the clay, allowing them to be more easily activated. AO has the potential to activate the seacoal causing the mold to absorb VOCs. Hazardous pollutants and VOCs are oxidized within the green sand mold, and the amount of clay and seacoal required in the mold are reduced. Smoke and odor emitted during cooling and shakeout can be reduced significantly.

REDUCING FOUNDRY EMISSIONS

Test results in green sand foundries have been positive. Emissions and sand requirements in participating foundries have been reduced significantly.

Advanced oxidation processing has reduced smoke, odor and emissions in foundries.

Project Description

Goal: The goal of this research is to understand and further develop cost-effective non-incineration techniques that will significantly reduce VOC emissions from foundries.

Progress and Milestones

This three year project began in October 1998. Specific tasks include:

- Controlled Foundry Trials - These trials are evaluating the sand system and environmental performance of advanced oxidant (AO) green sand systems using AO additions, AO additions with black water collectors, and AO additions with dust re-activation for bond recovery.

- Laboratory Testing - Pennsylvania State University Metal Casting Laboratory bench-scale tests are being conducted to further understand AO-green sand system interactions and their effects on sand system performance and emissions.

- Analytical Studies - Analytical studies will be performed to evaluate AO-green sand reactions and reaction kinetics.

- Technology Transfer - Results will be communicated through the AFS Casting Congress and future AFS Environmental Affairs Conferences. Results are also being disseminated through individual AFS Technical Committees and through the trade press.

Results to date have been positive. At the Neenah Foundry, AO technology has reduced sand system bond usage by 15 percent with an associated reduction in emissions from cooling and shakeout. At International Truck & Engine's Waukesha plant, stack tests conducted in 1999 showed a 56 percent reduction in benzene per tone of iron poured and a 74 percent reduction of VOCs (including benzene) per tone of iron poured. Tests have also demonstrated that CO emissions have been reduced by 10 percent as a direct result of sand system optimization. Significant cost reductions have been achieved at both foundries due to reductions in sand system clay (bond) requirements.

Project Partners

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Grede Foundries, Inc.
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