METALCASTING

Project Fact Sheet

Die Casting Copper Motor Rotors

Benefits

- Decreased energy requirements compared to aluminum motor rotors, saving an estimated 143 billion Btu annually
- Reduced air emissions, including greenhouse gases, due to reduced energy consumption, totaling a projected 9.7 million tons annually
- Improved motor efficiency by 15% to 20%
- Reduced production time and hand labor compared to former methods of producing copper motor rotors
- Decreased operating costs compared to conventional motors

Applications

Electrical motors are used throughout U.S. manufacturing agricultural irrigation. Motors account for more than 60% of all electricity use in the Nation. The market for electric motors totals about $35 billion per year internationally and about $10 billion in the United States.

Using High-Temperature Materials to Die Cast Copper Motor Rotors Efficiently

Though it conducts electricity less efficiently than copper, aluminum is preferred for manufacturing conductors in electric induction motor rotors. Aluminum can be die cast relatively easily and is the industry's preferred fabrication material. Before aluminum die casting was developed, rotors were hand-fitted with individual copper conductors that were then joined into a complete rotor conductor system by hand labor.

Die casting copper conductor rotors (CCRs) has not been successful because conventional casting molds suffer thermal shock, shortening mold life and increasing operating costs. ThermoTrex Corporation proposes to fabricate cost-effective molds using high-temperature, thermal shock-resistant materials designed to perform for economically acceptable lifespans of thousands of casting cycles. This project responds to the Congressional mandate to increase the electrical efficiency of integral horsepower motors sold in the United States.

Die Casting Copper Conductor Rotors

By developing motor rotor molds that can withstand the high temperatures needed for die casting copper, ThermoTrex Corporation will enable motor manufacturers to produce more efficient electrical motors that use less electricity and save on costs and greenhouse gas emissions.

OFFICE OF INDUSTRIAL TECHNOLOGIES
ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

Project Description

Goal: The goals of this project are to design, fabricate, and demonstrate molds that will withstand the copper motor rotor die casting environment for an economically acceptable life of 1,000 or more cycles.

Using an innovative chemical vapor composites material-forming process, ThermoTrex will demonstrate that tungsten and molybdenum can be used to manufacture cost- and energy-efficient casting molds.

Progress and Milestones

- Contract negotiations have been completed with ThermoTrex.
- The injection molding facility at the Buhler Casting Development Center has been modified with funding provided by the Copper Development Association to permit rapid melting and injection of molten copper as required to support the program.
- Work is proceeding toward completion of Phase 1: Materials Screening and Assessment. Test injection die inserts of tungsten/molybdenum have been fabricated, along with a comparison set made of H-13 steel and other selected alloys. These tests are subjecting the test dies to production-rate shots of liquid copper to validate the material selection and anchor thermal model data.
- Work has been initiated on Phase B: Initial Mold Tests. Design efforts have begun on dies for the fabrication of the first copper motor rotors. Injection molding of the first rotors is scheduled for late 1998.

Short Copper Motor Rotor Fabricated in a Recent Test

Industry of the Future—Metal Casting

The metal casting industry – represented by the American Foundrymen's Society (AFS), North American Die Casting Association (NADCA), and the Steel Founder s Society of America (SFSA), has prepared a document, ***Beyond 2000****," to define the industry's vision for the year 2020. OIT's Metal Casting Vision Team partners with metalcasters, national laboratories, universities, and trade/environmental/technical organizations to develop and implement energy efficiency technologies that benefit both the industry and the United States. Recently, the Metal Casting Team facilitated the develop ment of the Metal Casting Technology Roadmap, which outlines industry's near-, mid-, and long-term R&D goals.*

OIT Metal Casting Industry Team Leader: Harvey Wong (202) 586-9235.

NICE^3—**N**ational **I**ndustrial **C**ompetitiveness through **E**nergy, **E**nvironment and **E**conomics is an innovative, cost-sharing program that promotes energy efficiency, clean production, and economic competitiveness in industry. This U.S. Department of Energy (DOE), Office of Industrial Technologies grant program provides financial assistance of up to $525,000 to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. The industrial partner may receive a maximum of $500,000 in federal funding. Non-federal cost share must be at least 50% of the total cost of the project.

Project Partners

Division of Energy Resources
Boston, MA

NICE^3
Department of Energy
Washington, DC

ThermoTrex Corporation
San Diego, CA

For project information, contact:

Mr. John G. McCoy
ThermoTrex Corporation
10455 Pacific Center Court
San Diego, CA 92121-4339
Phone: (619) 646-5403
Fax: (619) 646-5301
jmccoy@thermotrex.com
http://www.thermo.com/subsid/tknl.html

For more information about the NICE^3 program, contact:

Lisa Barnett
NICE^3 Program Manager
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

Visit our home page at
www.oit.doe.gov

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
1000 Independence Ave. SW
Washington, DC 20585-0121

DOE/GO-10098-595
September 1999