lift LIGHTWEIGHT INNOVATIONS

Technology Project Abstract:

Melt R2-2: In-Situ Manufacturing of Nanoparticle Reinforced Aluminum Matrix Composites

Lead Industry Partner: North American Die Casting Associtaion (NADCA)

Technology Pillar: Melt Processing

Lead Research Partners:

Worcester Polytechnic Institute
The Ohio State University

Project Summary

This project intends to scale-up a process for producing aluminum-based nanocomposite material and develop process technologies for cast products with improved performance of large, single-piece cast products. The improved performance will increase stiffness and fatigue strength.

Technology Gap / Need

Aluminum alloys are used extensively in the automotive and aerospace industries because of their high strength-to-weight ratio. While some have very high strength, further strength improvements can be achived by incorporating nano-sized particles in the aluminum matrix, as well as the mechanical properties at an elevated temperature.
Monolithic aluminum alloys are not useful in such applications, so there is a need for a lightweight, thermally-stable material that can be produced economically with little disruption to existing manufacturing infrastructure.

Focus/Technology

Three routes have been identified. Each of the three process routes will be scaled up to produce several pounds of material. The material will then be cast in a laboratory and chracterized by mechanical property and microstructural analysis in both the as-cast and heat-treated condition.
Machining studies will then be conducted to determine the machining process parameters.
The three process routes include:

- In-situ gaseous reaction
- In-situ self-propogating high temperature in the explosion mode
- Ex-situ ultrasonic dispersion

Project Benefits

The major benefits of this project are the reduction in component weight due to improved room temperature properties as the ability of aluminum to operate at higher temperatures due to better elevated temperature endurance.

Education & Workforce Impact

Students engaged with this project will be participating in real manufacturing environments and will be provided the opportunity to learn about aluminum nanocomposites, die casting and component design.

Project Duration

Start: March 2017
End: December 2018

Funding

Total Project Value: $2.3M

Participants

Industry Partners
NADCA
ECK Industries, Inc. Eaton
Terves
Nemak

Research Partners
WPI
Case Western Reserve University
University of Michigan
The Ohio State University
MIT