

Metal-Matrix Composites and Thermal Spray Coatings for Earth Moving Machines
Quarter 1 Report

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Abstract:

First quarter activities were limited to initial project discussions, laboratory preparation, and some initial coupon preparation. Technical discussions were held with the subcontractors to clearly define their role in the project. Detailed preparation of the pressure casting lab was started. Initial test coupons were sprayed and provided to Oak Ridge National Lab for infrared lamp fusion trials.

Introduction

This project has two parallel thrusts, (1) developing a cost effective, pressure assisted casting process and optimal structure for abrasion resistant steel metal-matrix composites, and (2) developing a process to create dense, metallurgically-bonded abrasion resistant thermal spray coatings. It is felt that these parallel thrusts are required to address the diverse wear modes and component function requirements of mining machines.

Experience is continuing to show that the advanced materials being explored will be required to consistently provide a greater than 2x increase in component wear life. Final contractual documents for this project were signed by Caterpillar on February 28th. This closure date delayed the project start, however some preparatory elements were pursued in anticipation of the project start.

Experimental

Steel Metal Matrix Composites

Travel was conducted to the University of California at Santa Barbara in order to introduce them to the project and discuss their role. UCSB will be working on two elements of the steel matrix composite project. The first area of study will look at the infiltration and wetting characteristics, as well as resulting particle-matrix interfacial characteristics of different hard particle and particle coating schemes. The second element will come as pressure cast composites are produced at Caterpillar. UCSB will evaluate the fracture toughness and fracture characteristics of the composites to provide further guidance on particle and matrix choice. Subcontract negotiations with UCSB were started.

Preparations of the pressure casting lab at the Caterpillar Technical Center actually started last year, as part of a Caterpillar internally funded effort. At that time tooling was fabricated for the initial pressure casting experiments. A schematic drawing of the tooling and description is provided in the appendix. A small induction melting furnace was ordered for the lab and will be purchased with Caterpillar capital funds, entirely outside of this project.

Thermal Spray Coatings

Discussions were held late in 2000 with Craig Blue of Oak Ridge National Lab regarding infrared lamp processing and capabilities. In the first quarter of 2001 coupons were prepared for initial high-density infrared processing trials at ORNL. A description of the materials and spray processes used for the initial coupons is provided in the appendix.

Results and Discussion

At this time there are not results to discuss

Conclusions & Future Work

For steel MMCs casting lab preparation will continue through the second quarter, with the expected installation of the induction melting furnace in July. Work will begin on hard particle selection and identification of potential coatings. Investigation will also continue on methods to create hard particle preforms, building off of prior work at Caterpillar.

For thermal spray coatings, it is expected that ORNL will be able to perform initial infrared lamp processing trials in the 2nd quarter