

Fly Ash-Enhanced Aluminum Composites for Automotive Parts

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Report for October 1997 to December 1997

January 2, 1998

Objective:

- To produce and evaluate the use of aluminum "ashalloys" – metal matrix composites that incorporate coal fly ash – in the commercial manufacture of cast automotive parts.

Highlights:

Results of the team coordination meeting in October included:

- Determination of casting techniques from the candidates of squeeze, high pressure, low pressure, sand casting, and gravity pour;
- Selection of the low stress/high stress automotive parts from the candidates of brake rotors, intake manifolds, and engine mounts;
- Integration of the tasks essential for evaluating the fly ash characteristics and appropriate percentages of cenospheres or precipitator in the parts.

Progress

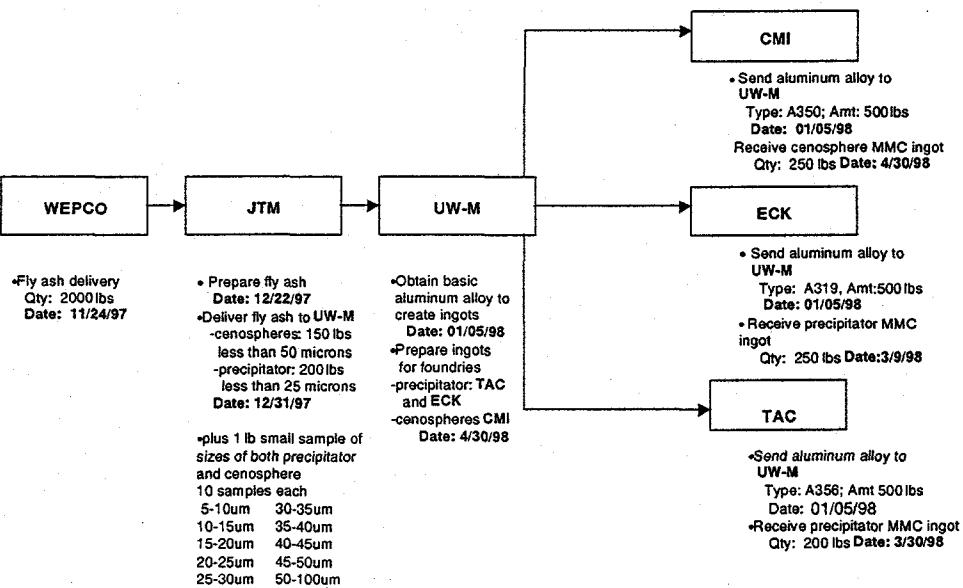
Fly ash from two plants of Wisconsin Electric Power Company (WEPCo) was dispatched to the laboratories of JTM and UW-M for screening, characterization, and beneficiation. The fly ash was classified into different size fractions and is being analyzed for chemical composition and microstructure. Currently, fly ash beneficiation is removing the carbon, magnetic fractions, and sulfur. After classification and screening, JTM will deliver the processed fly ash to UW-M. Foundries are providing UW-M with information on the specific alloys needed for parts. Thompson Aluminum sent the base alloy 356 to UW-M where, in turn, small size ingots were prepared with fly ash from WEPCo. UW-M will continue process development and preparation of specific MMC ingots for foundries' parts production.

Milestones:

Many of the program tasks are iterative over quarters, but findings considered milestones were:

- Collection and processing of fly ash; and
- Predictions on microstructures and alloy composites including type, size, and amount of fly ash for component property requirements.

QUARTERLY ACTIVITIES



Fly Ash-Enhanced Aluminum Composites for Automotive Parts

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Report for January, 1998 to March, 1998

April 9, 1998

Objective:

- To produce and evaluate the use of aluminum "ashalloys" – metal matrix composites that incorporate coal fly ash – in the commercial manufacture of cast automotive parts.

Highlights:

- U.S. Patent No.5,711,362 was issued January 27, 1998 in response to the Patent Application dated November 29, 1995. The topic is: "Method of Producing Metal Matrix Composites Containing Fly Ash". Dr. Pradeep Rohatgi is the inventor. The Electric Power Research Institute is the assignee.
- Processed, fine-sized, precipitator fly ash particles were delivered and characterized by particle morphology and size distribution.
- Ashalloy ingot was synthesized with nine heats of aluminum alloy A356 - 10 wt% precipitator fly ash.
- Test ingot was delivered to one foundry (TAC).
- A team meeting will be held in May at UW-M to review the program and plans.
- The foundries TAC and ECK will perform the sand casting technique in place of CMI.

Progress:

Since filler particle size reduction tends to improve MMC properties, a critical task is to determine the smallest particle diameter which still allows uniform distribution in the ashalloy composite. Product morphology determined that most of the delivered fine fly ash particles were close to a perfect spherical shape and measured less than 5 micrometers. In nine heats, these particles were introduced into the molten aluminum using the stir casting technique. Some agglomeration and clustering with this fly ash was noted. The results provide the basis for modifying the mixing process and pre-treating the fly ash.

Milestones:

Many of the program tasks are iterative over quarters, but events considered milestones were:

- Delivery of processed fly ash to UW-M.
- Initiation of Task 3: Preparation of initial ashalloy ingots

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