

Aluminum-Fly Ash Metal Matrix Composites for Automotive Parts

Report for October 1 to December 31, 1999

January 15, 2000

David Weiss, Robert Purgert, Foundry Participants
Richard Rhudy, The Electric Power Research Institute (EPRI)
Pradeep Rohatgi, University of Wisconsin at Milwaukee

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Highlights:

- Fly ash classified by less than 100 microns in size was mixed into a 300 lb. melt of alloy 535 without the need of a magnesium additive.
- A vibratory feeder fitted with a sieve was used as the means to minimize particle clustering while introducing fly ash into the aluminum alloy 535 melt.
- The industrial-size field test was successful in that sand mold castings and permanent mold castings of tensile bars, K mold bars, and ingots were made from aluminum alloy 535-fly ash mix.

Progress:

Use of aluminum alloy 535 containing 7% magnesium precluded the need to introduce additional magnesium into the melt. The third round of sand mold castings as well as permanent mold castings produced components and ingots of alloy 535 instead of alloy 356. The ingots will be remelted and cast into parts to assess the improvement of flyash distribution which occurs through reheating and the solidification wetting process.

Microstructure analysis continues on sand and permanent mold castings to study particle distribution in the components. A prototype sand cast intake manifold casting was found to be pressure tight which is a major performance requirement for this part. Another heat of pressure die cast brackets of A380-classified fly ash will be made to examine their strength and fly ash distribution. Ingots of A356-fly ash have been made at Eck for remelting at Thompson Aluminum for squeeze casting into motor mounts.

Milestones:

As properties and fly ash distribution improve, parts will be sent to auto companies for testing. It is projected that prototype parts will be installed in some cars for evaluation during the year 2000.

Aluminum-Fly Ash Metal Matrix Composites for Automotive Parts

Report for January 1 - March 31, 2000

April 19, 2000

David Weiss, Robert Purgert, Foundry Participants
Richard Rhudy, The Electric Power Research Institute (EPRI)
Pradeep Rohatgi, University of Wisconsin at Milwaukee

Highlights:

- A two impeller mixer was designed and simulated on water and small melts at the UW-M laboratory. Based on the results, a large two impeller mixer was assembled and attached to the lanxide mixer at Eck Industries. The system was tested with a 300 pound heat.
- Several surfactants have been tested to reduce agglomeration of flyash particles during storage.
- Simulations have been carried out with different temperature-speed cycles of impellers to improve the distribution of flyash during remelting of ingots. Cooling curves of Ashalloy have been determined.

Progress:

The two impeller mixer appears promising with the top impeller pumping liquid downward toward the bottom, high shear impeller for the purpose of dispersing clustered particles. Improved distribution and reduced porosity were noted in the small melt simulations of these impellers. Experiments in industrial heats are being undertaken at Eck to demonstrate the scalability of the results. Ingots are being remelted and stirred using the new two impeller mixer to obtain sand cast parts. These and other pressure die cast parts will be examined for microstructure and properties. Cooling curves of alloys containing flyash have been determined to provide the basis for designing Ashalloy mixing cycles and pouring cycles. Several surfactants have been mixed with flyash to reduce the tendency of agglomeration prior to and after additions to the melt.

Milestones:

As microstructure and selected properties become acceptable, sample parts will be sent to auto companies for their evaluation by the end of December, 2000.

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