AMC
AMERICAN METALCASTING CONSORTIUM

APPLICATIONS OF NANOSTRUCTURED CAST ALLOYS

This AMC research project, managed by the American Foundry Society (AFS) and Eck Industries, is developing several methods for the large-scale production of nano-reinforced aluminum alloys. These alloys can be significantly stronger than standard aluminum alloys but have equivalent density, making them ideal candidates for structural military components. Lessons learned from previous developmental work and other projects are being leveraged to scale up and implement the technology.

SUCCESS STORY

Problem: Mortar base plates, typically made from steel to accept the high tensile loads, are heavy and difficult to carry. Optimized designs have a significant variation in section thickness making them difficult to feed. This problem is compounded in high strength alloys which can hot tear when solidification rates vary within the casting. Casting alloys such as A206 and wrought alloy compositions such as 7075 are required to meet the strength requirements of the castings.

Solution: Nano-reinforced alloys can be produced using several different methods. Particles can be added ex-situ directly, introduced in the molten metal stream, or through a master alloy. Nano particles also can be produced in-situ through reactions of flux, gasses, polymers, or other precursors. Based on the success of the production of ballistic plates using an in-situ flux reacted material (titanium containing flux and activated carbon to produce TiC), that method was chosen to produce light-weight mortar base plates. The goal was to increase strength with enhanced castability in strong alloys while reducing the weight of the base plates by at least 50%. Conforming castings were produced in both modified A206 and 7075 alloys.

Benefits: This in-situ technique is faster than ex-situ processing and the cost of materials is less. Related work, funded by a SBIR from Benét Labs to Loukus Technologies, is focused on producing the parts as low-pressure sand castings. This will then transition to metal-mold casting to further reduce the cost. The benefit to the warfighter is substantial, enabling improved mobility and faster deployment. The techniques developed in the production of these castings can be used to further other lightweighting goals of the military.

"This project brings us closer to achieving the lightweighting goals of our customers. The ability to produce castings in strong alloys without compromising geometry opens a door to many new military and commercial applications."

Adam Loukus, President Loukus Technologies, Inc.

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