

AMC

AMERICAN METALCASTING CONSORTIUM

ADVANCED METAL MATRIX COMPOSITES FOR CASTING APPLICATIONS



The Superior Weapons Systems through Castings (SWC) Program, sponsored by Benet Laboratories, was a collaboration between Benet Labs and the American Metalcasting Consortium (AMC) to facilitate design and manufacturing methods to meet future defense requirements. One of the program's objectives was to reduce system weight and service life through material optimization to produce stiffer and lightweight components.

The Non-Ferrous Founders' Society (NFFS) teamed with M Cubed Technologies and Net Shape Solutions to evaluate cast aluminum silica carbide (SiC) metal matrix composites (MMC) for military applications. These materials offer higher stiffness and lower thermal expansion than aluminum, and with a high SiC content, these materials can reach the stiffness of steel while maintaining aluminum like density.

SUCCESS STORY

Problem: The historical challenge with cast MMC materials is that SiC content has been limited to 30 volume percent. Above this level, casting was not possible because the MMC slurry became too viscous and properties were not superior to competing materials such as ceramic matrix composites, wrought aluminum, and steel.

Solution: M Cubed Technologies successfully developed a novel approach to make an aluminum-silicon carbide composite casting with 55% loading via a gravity pour process and utilizing conventional molding methods that may be implemented in most foundry operations. The demonstration component created was a thermal management plate used in avionic systems like the F-15.

Benefits: Defense and commercial markets have a new high strength, light-weight casting material available that provides superior properties for a variety of applications.

- Potential 40% cost reduction over (Cu/Mo/Cu) and Ceramic Matrix Composite applications
- 180% higher stiffness than monolithic aluminum materials
- Average of 30% weight reduction for steel applications

Material	AL/SiC-55p Advantage
Ceramic Matrix Composites	Higher toughness, machinability
Steel	Comparable stiffness, lower weight
Aluminum (Wrought and Cast)	Higher stiffness and lower CTE
Copper clad molybdenum (Cu/Mo/Cu)	Lower density, cost, weight



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