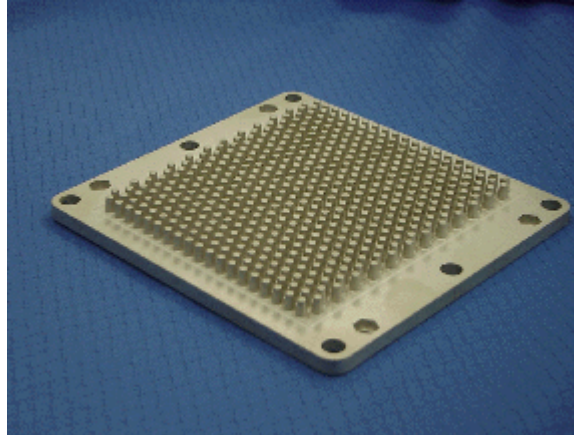


PEBB Power Electronic Building Blocks

Objective:

The objective of this program is to develop manufacturing technologies for Metallized Matrix Composite (MMC) baseplates, which will be used in Power Electronic Building Blocks (PEBBs) to provide highly-reliable and affordable packages for modular high power converters. Conventional baseplate materials, such as copper, do not provide adequate performance and reliability for high power applications. In contrast, aluminum metal matrix composite (Al-MMC) baseplates provide an enabling technology for PEBB modules. A PEBB is a universal power processor which will convert any electrical power input to any desired form of voltage, current and frequency output. The baseplate provides the thermal management system, in addition to being the mechanical support structure for the module. This program will establish Al-MMC base plates as the preferred thermal management solution for high power, compact, low cost and highly reliable electronic power modules. Manufacturing processes will be optimized, production costs reduced, and processes for fabricating components with more complex geometries will be developed and demonstrated.



Benefits:

An overall objective of the Navy MANTECH Program is to significantly improve the affordability of Navy systems by engaging in manufacturing initiatives that address the entire system life cycle. The Office of Naval Research wants to ensure the availability, affordability and performance of metal matrix substrates, a critical component for the next generation of advanced Naval power control applications. This program will benefit the Navy by providing affordable MMC baseplates with high thermal and mechanical performance, which will lead to a substantial increase in the reliability of PEBB modules. With this increase in reliability and efficiency, savings will be realized through reduced repair and maintenance costs of these weapon systems.

PEBB modules will replace complex power electronic circuits, since they will offer reduced design complexity, shorter time-to-market, and lower cost. They will have a 10x increase in power density, a 10x increase in reliability and a 5x decrease in system size and weight. Industry-wide commercialization of PEBB modules is required to meet the affordability goal of \$0.06/Watt for Naval applications.

Applicable Weapon Systems

Cost-effective power control and distribution is the key to implementing electric drive on future Naval platforms, like the DD-21. Technology development programs like PEBB, IPS (Integrated Power System) and ERS (Electrically Reconfigurable Ship) have demonstrated the technology and are studying the cost implications of a shift to electric propulsion/space control. MMC substrates are an enabling technology for these power controls.



Technical Approach

ACI has contracted with DMC2 (formerly Lanxide) to develop a high performance baseplate for power modules. These baseplates will feature integrated cooling pins for improved thermal management of PEBBs.

The development of this manufacturing technology will be accomplished by:

- Developing fabrication processes to produce baseplates with high thermal conductivity, high strength and complex geometry in the lab
- Transitioning these processes to the production floor
- Instituting additional cost reduction methods into production line
- Demonstrating the baseplate cost reduction effort utilizing a production run
- Verifying the thermal and mechanical performance of the production baseplates