Fabrication and Validation of High Strength Aluminum Plates for Ballistics and Structures (Task N.0819)

Statement of Need

Aluminum-scandium (Al-Sc) alloys have shown promise for armor application in future DoD weapon systems. Initial mechanical and ballistics trials of 1-inch thick plates indicate significant performance gains beyond the currently used Al-alloy 5059-H131. Further refinements and optimizations in the composition and processing of these alloys, to be used for armor and structural plates, are needed for military weapon systems application and are expected to result in gains in mechanical and physical properties, such as increased material strength and decreased weight. The refinements and optimizations will include potential constituent modifications to utilize less costly materials, i.e. alternatives to Sc. These gains would translate to decreased fuel consumption and significantly less mechanical wear on the main drive train components for ground weapon systems over the system's lifecycle.

Technical Approach

Previously conducted evaluations and test efforts have shown some of the ballistics and structural advantages of Al-Sc alloys for use with ground combat vehicles. The favorable improvements of these properties may enable the design of lighter weight systems without the loss of protection, which translates to decreased fuel consumption and significantly less mechanical wear on the main drive-train components for ground weapon systems throughout their life cycles.

Material research, fabrication, and testing were conducted by the NDCEE to validate and document the properties of these enhanced alloys. The NDCEE fabricated and validated Al-Sc alloy plates and plates that contain alternate alloy formulations that utilize Sc substitutes. The objective was to provide the Government with full-scale test plates of specific formulations that maintain similar functionality of the Al-Sc plates, but at a lower cost. Upon completion of the fabrication and validation efforts, these sample plates were delivered to the Government, specifically the Army Research Laboratory (ARL), for analysis of the ballistics and corrosion properties.

Government POC
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Status
Complete

Results and Benefits

The NDCEE expected that the results of this task would have the potential to improve the ballistics and structural capabilities of ground combat systems, including add-on packages and future ground vehicles and weapons systems. In turn, the results were expected to move towards reducing the overall life-cycle costs of ground combat vehicles resulting from reductions in fuel consumption, maintenance, and overall vehicle wear and tear.

Technology Transfer and Outreach

The material characterization and validation efforts of this task may have significant application beyond ground combat vehicles. The NDCEE reported the results of this effort to the ARL.