Topic: N13A-T012

Imaging Systems Technology

Mechanical Property Characterization and Modeling for Structural Mo-Si-B Alloys for High Temperature Applications
Mo-Si-B is a high temperature refractory alloy developed with the intent to replace nickel superalloys in rotating and static jet engine components. The Navy and Air Force have invested in the development and refinement of this material. Imaging Systems Technology (IST) focuses on developing advanced materials through innovative process advancements having a diverse IP portfolio including material processing and fabrication techniques. IST has scaled the production of Mo-Si-B powder to be used as feed stock for the manufacture of powder metal parts while maintaining quality metrics. IST has produced Mo-Si-B components demonstrating oxidation resistance to 1300°C. Transition to commercialization includes relationships with manufacturers of engines or equipment requiring cost effective materials to withstand the rigors associated with demanding hot temperature applications.

Technology Category Alignment:

Air Platforms
Materials & Manufacturing Processes
Weapons Technologies

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SYSCOM: ONR
Contract: N00014-15-C-0069
Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00014-15-C-0069

Department of the Navy SBIR/STTR Transition Program

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ONR Approval # 43-2203-16

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WHO

SYSCOM: ONR

Sponsoring Program: Propulsion Materials Program

Transition Target: Jet engine hot gas stream static components.

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Other transition opportunities: AFRL/RXCM has expressed interest in Mo-Si-B and has purchased small test panels for the CRDE (Continuous Rotary Detonation Engine) test rig.

F-35B Lightning II , 03/08/2016, 160308-M-BL734-845,
U.S. Marine Corps Photo by Cpl. Jonah Lovy/Released

WHAT

Operational Need and Improvement: Currently Mo-Si-B can only be manufactured by a handful of lab scale production techniques. Transitioning Mo-Si-B to a "production ready" state requires development of a robust scaleable process.

Specifications Required: Ultimate Tensile Strength 60ksi.
Tensile Strength Characterization RT to 1370 degrees C.
Static Oxidation Resistance between 815 to 1370 degrees C.

Technology Developed: The team is investigating controlled atmosphere spray drying and post processing steps of the Mo-Si-B alloy. These techniques enable the ability to produce controlled microstructure as well maintain quality in the scaled process.

Warfighter Value: US military aircraft can realize significant (20-40%) fuel savings from jet engine components made of Mo-Si-B materials. Aircraft will benefit from tough, oxidation resistant alloy composites, usable in air to 1370 degrees C.

WHEN

Contract Number: N00014-15-C-0069 **Ending on:** January 30, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Oxidation resistance at 1,200 degrees C	N/A	300 mg/cm^2 weight loss at 500 hours.	3	January 2012
Oxidation resistance at 1,300 degrees C	N/A	20 hour weight loss rate below 0.05 mg/cm^2-hr	3	May 2015
Small billet production	N/A	Billet over 200g with density beyond 95% of theoretical	3	March 2016
Test of Mo-Si-B panel on Continuous Rotary Detonation Engine.	N/A	Component survived the full duration of the test at maxiumum temperature.	5	March 2016
Testing of Mo-Si-B component on static jet engine rig	Med	Component meets or exceeds required test metrics	7	June 2017

HOW

Projected Business Model: Imaging Systems Technology (IST) will team with prime contractors to supply raw materials for part manufacturing.

Company Objectives: Imaging Systems Technology desires to become a strategic supplier of the Mo-Si-B technology and finished alloy powder to the aviation industry.

Potential Commercial Applications: Components of future engine designs such as the Continuous Rotary Engine (CRDE), Current engine combustor panels, flaps and seals are likely applications of the Mo-Si-B technology.

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