NASA SBIR/STTR Technologies

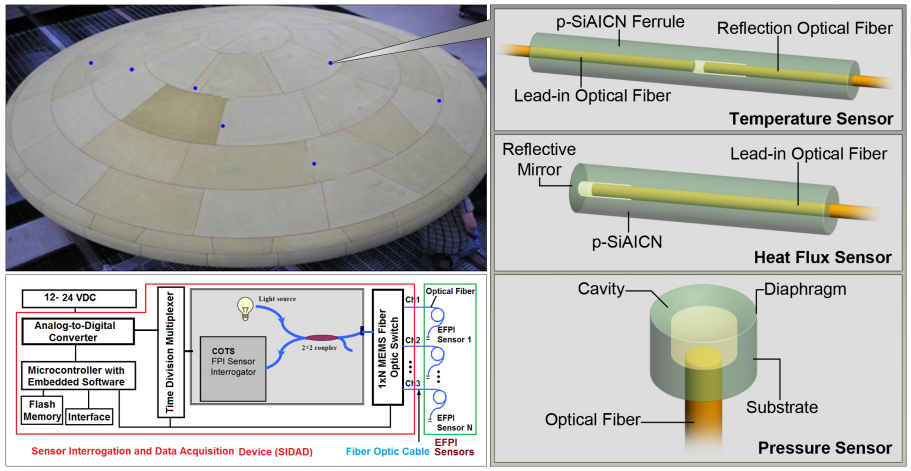
H7.01-9025 - Embedded Multifunctional Optical Sensor System

PI: Naibing Ma

Physical Optics Corporation - Torrance, CA

Identification and Significance of Innovation

To address NASA's need for in situ sensor systems for use on rigid and/or flexible ablative Thermal Protection System (TPS) materials, Physical Optics Corporation (POC) proposes to develop a novel Embedded Multifunctional Optical Sensor (EMOS) system providing accurate in situ measurement of multiple Thermal Protection System (TPS) structural, aerothermal, and aerodynamic response parameters including temperature, heat flux, and pressure. EMOS is based on further essential development, optimization, and improvement of the POC-developed fiber optic microsensor technology, which allows the measurement of multiple physical parameters (e.g., pressure, temperature, and heat flux) using a suite of miniature (diameter <400 micron) fiber optic Fabry-Perot (FP) interferometric sensors. EMOS will support an operating temperature range up to 1500 deg C and measurement errors within 0.4% for temperature sensors, 0.2% for pressure sensors, and 20% for heat flux measurement.



Estimated TRL at beginning and end of contract: (Begin: 3 End: 4)

Technical Objectives and Work Plan

Technical Objectives:
Objective 1. Development of EMOS preliminary design and analysis of its application scenario to determine the optimal parameters of the EMOS components.
Objective 2. Modeling of sensor performance and development of key technologies for implementation of EMOS Phase I prototype.
Objective 3. Assembly and testing of EMOS Phase I prototype and demonstration of EMOS feasibility.
Objective 4. Preliminary establishment of the EMOS commercial potential.

Work Plan:
Task 1. Develop the Overall EMOS System Architecture
Task 2. Design EMOS Sensors and Perform Modeling and Simulations of Their Performance
Task 3. Investigate and Develop Key Technologies for Fabrication of EMOS Sensors
Task 4. Develop EMOS Sensors for Phase I Testing
Task 5. Assemble and Test the EMOS Phase I Prototype
Task 6. Explore the Commercial Potential and Product Viability
Task 7. Manage Program and Prepare and Submit Reports

NASA Applications

EMOS can be used for measurement of TPS response in aerothermal and aerodynamic environments, providing better traceability from the modeling and design tools to actual performance. EMOS microsensors can be applied to different types of ablative materials used for TPS including but not limited to PICA, PICA-X, SIRCA, Superlight Ablator (SLA), and Avcoat, and those under development for planetary aerocapture and entry as well as return to Earth.

Non-NASA Applications

Health monitoring of military aircraft components; health monitoring of commercial aircraft engines, drive train systems, and utility systems; monitoring of coal-fired power plants, natural-gas-based power plants, geothermal plants, as well as other power-generation facilities throughout the nation.

Firm Contacts

Naibing Ma
Physical Optics Corporation
1845 West 205th Street
Torrance, CA, 90501-1510
PHONE: (310) 320-3088
FAX: (310) 320-4667