Plasma Processes, Inc.

Enhanced Blackbody Sensors for the Quench Module Insert

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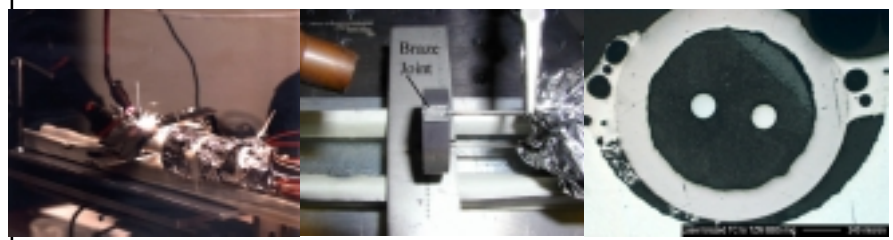
Proposal No.: 02-II B1.02-8784 Phase I contract: NAS8-03017

Description and Objectives

•Significant improvements in the ability of BlackBody Sensors (BBS) to monitor thermal performance can be realized by improving the joint quality between sensor rings and tantalum sheathed thermocouples.

•Modification of the sensor ring's surface properties to increase its apparent emissivity also benefit thermal performance monitoring.

•Enhanced laser brazing techniques for joining thermocouples to BBS rings, and high temperature emissivity coatings for 22% improved heat transfer into BBS rings were developed in Phase I



A B C

A – Photograph showing the laser brazing process
B – TZM BBS after laser brazing
C – Photomicrograph showing a cross-section of the braze joint revealing the need for improved laser brazing techniques.

Approach

•Redesign sensor ring thermocouple grooves to maximize capillary flow.

•Evaluate alternative braze materials for higher temperature use and improved flowability.

•Evaluate tantalum as a replacement for TZM sensor rings.

•Develop laser braze parameters for joining Ta sheathed thermocouples to Ta sensor rings.

•Evaluate TaC, SiC, TaN as emissivity coatings for Ta sensor rings.

•Thermal cycle tests to determine robustness of braze joints and emissivity coatings.

Subcontractor None

Schedule and Deliverables

• 24 months for development of the processes, fabrication of test articles, and characterization.

• Process specifications for flight hardware

• Final Report

NASA and Commercial Applications

• Improved thermal performance of the QMI.

• Joining of refractory metals, ceramics and composites

• Rocket motors, heat pipes, power generation, electronics, fuel cells, crucibles, water heater, boilers,