

**ADVANCED THERMAL BARRIER
COATING SYSTEM DEVELOPMENT**

CONTRACT # DE-AC05-95OR22242

TECHNICAL PROGRESS REPORT

to the

U.S. DEPARTMENT OF ENERGY

Oak Ridge Operations Office

Oak Ridge, Tennessee

January 13, 2000

Submitted By

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Advanced Thermal Barrier Coating System Development

Program Objectives

The objectives of the program are to provide an improved TBC system with increased temperature capability and improved reliability relative to current state of the art TBC systems. The development of such a coating system is essential to the ATS engine meeting its objectives.

The base program consists of three phases:

Phase I: Program Planning - Complete

Phase II: Development - Complete

Phase III: Selected Specimen - Bench Test

Work was performed in Phase II and III of the program during the reporting period.

Technical Progress Report

Task II.2 Bond Coat Development - Task Complete

No work performed during reporting period.

Task II.3 Analytical Lifing Model - Task Complete

No work performed during reporting period.

Task II.4 Manufacturing Process Development - Task Complete

No work performed during reporting period.

Task II.5 NDE, Repair and Maintenance - Task Complete

No work performed during reporting period.

Task II.6 New TBC Concepts

- In the previous reporting period, thermal fatigue life of one new ceramic composition deposited by EB-PVD was found comparable to that of 8YSZ. The superior performance resulted from a modification of the deposition conditions, which specifically addressed the failure mechanisms observed during furnace cycling. The new coating was then evaluated for sintering resistance by aging at ATS surface temperatures. No change in the intercolumnar spaces was detected after long term exposure, thereby clearly satisfying the requirements for maintaining a strain tolerant microstructure. The sintering resistance of the new TBC system was definitely superior to that of EB-PVD 8YSZ. Therefore, the above combination of good furnace cyclic life and superior sintering resistance of a phase stable compound is the key feature for a new composition for application as a TBC in the ATS engine.
- Based on the results from the laboratory scale evaluation, Siemens Westinghouse Power Corporation has successfully demonstrated a new TBC system for the ATS engine.
- The final program review was held in December, 1999. The review presented the above results in detail and clearly highlighted the achievements to date in the development program. Siemens Westinghouse has identified a TBC system that is expected to meet the ATS requirements, thus achieving the objective set forth in the proposal.
- A final report covering thermal barrier coating development is being prepared. The report summarizes all the results obtained in the development program since the initial award in 1996. The report is planned to be completed by end of January.

III.6 Blade and Vane TBC Monitor - Feasibility Study

- Based on the successful completion of real time imaging of thermal targets using an infrared camera, preparations are underway to interface the camera with a W501A engine located at Dow Chemical in Plaquemine, LA.
- Several engine options were discussed to provide the best test bed for demonstrating the on-line monitor and also completing the evaluation within a reasonable time frame. A 501A engine was identified due to its immediate availability and relatively easy access for the set-up of the camera. The demonstration is expected to be completed by early March.
- Purchase orders have been placed for Wayne State University and Dynamic Engineering to install the camera set-up at the engine site. The assembly of the camera is expected to be completed by the end of February, in time for the demonstration.