THERMAL BARRIER COATING LIFE MODELING IN AIRCRAFT GAS TURBINE ENGINES

D.M. Nissley
Pratt & Whitney
East Hartford, Connecticut

Analytical models useful for predicting ceramic thermal barrier coating (TBC) spalling life in aircraft gas turbine engines are presented. Electron beam-physical vapor deposited (EB-PVD) and plasma sprayed TBC systems are discussed. TBC spalling was attributed to a combination of mechanisms such as metal oxidation at the ceramic-metal interface, ceramic-metal interface stress concentrations at free surfaces due to dissimilar materials, ceramic-metal interface stresses caused by local radius of curvature and interface roughness, material properties and mechanical behavior, transient temperature gradients across the ceramic layer and component design features. TBC spalling life analytical models were developed based on observations of TBC failure modes and plausible failure theories. TBC failure was assumed to occur when the imposed stresses exceeded the material strength (at or near the ceramic-metal interface). TBC failure knowledge gaps caused by lack of experimental evidence and analytical understanding are noted. The analytical models are considered initial engineering approaches that capture observed TBC failure trends.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (*Leave blank*)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	March 1995	Conference Publication

4. TITLE AND SUBTITLE

Thermal Barrier Coating Workshop
Abstracts

5. FUNDING NUMBERS

WU-505-63-52

6. AUTHOR(S)

W.J. Brindley, W.Y. Lee, J.G. Goedjen, and S.J. Dapkunas, compilers

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

National Aeronautics and Space Administration
Lewis Research Center
Cleveland, Ohio 44135-3191

8. PERFORMING ORGANIZATION REPORT NUMBER

E-9509

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

National Aeronautics and Space Administration
Washington, D.C. 20546-0001

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

NASA CP-10170

11. SUPPLEMENTARY NOTES

Responsible person, W.J. Brindley, Materials Division, NASA Lewis Research Center, organization code 5160, (216) 433-3274.

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Unclassified - Unlimited
Subject Categories 26 and 27

This publication is available from the NASA Center for Aerospace Information, (301) 621-0390.

12b. DISTRIBUTION CODE

13. ABSTRACT (*Maximum 200 words*)

This document contains the agenda and presentation abstracts for the Thermal Barrier Coating Workshop, sponsored by NASA, DOE, and NIST. The workshop was held in Westlake, Ohio, March 27-29, 1995. The workshop covered thermal barrier coating (TBC) issues related to applications, processing, properties, and modeling. The intent of the workshop was to highlight the state of knowledge on TBC's and to identify critical gaps in knowledge that may hinder TBC use in advanced applications. The workshop goals were achieved through presentations by 22 speakers representing industry, academia, and government as well as through extensive discussion periods.

14. SUBJECT TERMS

Thermal barrier coating; TBC; Engine experience; Properties; Modeling; Processing; Aircraft engines; Land-based; Gas turbine engines; Diesel engines

15. NUMBER OF PAGES
31

16. PRICE CODE
A03

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	